A TREATISE

THE STRUCTURE

THE SPLEE

WITH ADDITIONAL NOTES AND A

EDWARDS CRISP, M

LONDON:

To the Library of the Medical Society of London from the Author

A TREATISE

THE STRUCTURE AND USE

OF

THE SPLEEN;

BEING

ONE OF THREE UNSUCCESSFUL ESSAYS FOR THE ASTLEY COOPER PRIZE, AWARDED JULY, 1853.

WITH ADDITIONAL NOTES AND AN APPENDIX,

CONTAINING

An Exposé of the numerous Errors in the Prize Essay.

BY

EDWARDS CRISP, M.D.

LATE PHYSICIAN TO THE METROPOLITAN DISPENSARY, CORRESPONDING MEMBER OF THE MEDICAL SOCIETY OF NISMES, CORRESPONDING MEMBER OF THE SOCIETY OF NATURAL HISTORY OF MONTREAL, ONE OF THE COMMITTEE OF THE PHYSIOLOGICAL SOCIETY OF LONDON, FELLOW OF THE ZOOLOGICAL SOCIETY, &c.

RES, NON VERBA QUÆSO.

LONDON:
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PREFACE TO THE PRINTED ESSAY.

How is the reader to know that this Essay is a copy of the one sent to Guy's Hospital? My reply is, that with a few verbal amendments, it is printed *verbatim* from the original Essay; all these slight alterations being made in pencil or in red ink. The Essay is now with the preparations and drawings (excepting the printer's disfigurements,) in the same state as when sent to Guy's Hospital.

If I had not printed this Treatise *verbatim*, I should not have used many modes of expression that I have done; some of them hastily penned, and others curt and indefinite.

As an excuse for this, I may remark as stated at pages 152, 161, and 173, that I had not time to examine the Essay after it was copied; I may likewise add, that I did not, until the 2nd of February, eleven months before the Essay was sent in, know even the subject of the Prize, although it had been announced two years before. During these eleven months, however, I worked without cessation, and I was enabled to obtain the greater part of the information that I have placed before my readers. It must be remembered that the *relative weights in the original tables were not appended, that all new matter in this Essay is in the smallest print, and begins with a* ¶, *and that some of the drawings are*

likewise new, as mentioned in the description of the Plates.

The reader may naturally ask "*After all this labour and expense, what good have you accomplished?*" "*Do we know more about the Spleen than we did before?*" I answer, by pointing to my preparations and drawings, and especially to the discovery of the *constant* existence of valves in the splenic and other abdominal veins of many animals; to the investigations respecting the pathology of the Spleen of the lower animals; to the *comparative* experiments on extirpation of the Spleen, and to the estimates of the relative weights of the various organs of the body in the different classes of the vertebrata; a mode of investigation, *that will hereafter, I believe, lead to important physiological results.*

But let me briefly allude to some published statements respecting the Spleen before I began this enquiry; and most of these errors, as I have shewn in the Appendix, are repeated by the gainer of the Prize.

In "*Cruveilhier's Descriptive Anatomy,*" revised by Dr. Sharpey, Library of Medicine, vol. 7, p. 537, it is stated "that the Spleen is larger in man than in the lower animals, the proportion to the body in man being $\frac{1}{200}$." But in many of the lower animals, as I have shewn, the Spleen is proportionately larger than in man. Cuvier in the first edition of his "*Anatomie Comparée,*" vol. iv. p. 57, 1805, says, "the size of the Spleen diminishes successively in the four classes." This statement has been copied by a host of imitators, who like many of the writers in our Cyclopædias, abstract from foreign authors, without acknowledgment, but do not investigate for themselves!

In the last edition of "*Cuvier's Anatomie Comparée,*"

by Duvernoy, 1835, it is stated in a parenthesis, vol. iv. p. 616, in allusion to the foregoing paragraph, "that the above proposition applies more particularly to birds and reptiles, but it is not applicable to fishes, in which the Spleen has often appeared to us to bear a proportion not less than in mammals."

I have already alluded to the opinions of other writers respecting the size of the Spleen, pages 21, 22, and 29. Professor Owen, in his Lectures on Zoology, has barely spoken of this organ; and in his published Lectures on fishes, I quote the only allusion, I think, to it.

"But the most common modification of the visceral vascular system is the sudden division and termination of a branch, usually of the gastric artery, in a small body chiefly composed of the cellular beginnings of the returning veins, forming the vaso-ganglion so constant in all higher Vertebrates, and called the 'Spleen' (*fig.* 61. *n*). It is not present in the Lancelet; and the gland-like bodies near the cardia in the Cyclostomes, and near the pylorus in the Lepidosiren, which some have called 'Spleen,' are more like the recognised remnants of the vitellicle in osseous fishes, where a true spleen is actually present. The vein of the Spleen always contributes to form the 'vena portæ;' but it is important to note that it is not essential to the formation of that vessel. The absence of the Spleen in fishes is concomitant with the absence of the pancreas; and the increased size and complexity of the Spleen is associated in some fishes with a corresponding development of the pancreas. Thus there is an accessory Spleen in the Sturgeon; and the Spleen is divided into numerous distinct lobules in Lamna, Selache (see part of the organ in *fig.* 64. *s*), and some other highly organised Plagiostomes. In most osseous fishes the Spleen is appended by its vessels, and a meso-splenic fold of peritoneum to the hinder end or bend of the stomach, or to the beginning of the intestine: it is of variable but commonly triangular shape; of a deep red or brown-red colour, and soft and spongy: the venous cells of which it is chiefly composed are filled with granular corpuscles."

As regards the valves in the splenic vein, I believe that they had been described in one or two animals

as of occasional, but not of *constant* occurrence; and the circumstance I have mentioned at page 179, that Dr. Carpenter, as appears by his Review of the Prize Essay, a few months since, was ignorant of their presence, is sufficient to establish the fact. In a dissertation on the Spleen, by Hlasek, "*Dissertationes de Structurâ et Texturâ Lienis*," 1852, he remarks "*Vena lienalis quam novimus valvulis carere in bove, atque ceteris animalibus.*" Dr. Thudichum tells me that Weigel was the first to draw attention to the existence of valves in the portal vein of the horse and ox in his Treatise "*De strato musculoso tunicare venarum* Lips. 1823." I have not been fortunate enough to procure the book, but I *think* it will be found, that no one has described these valves in the splenic veins of the ox and horse, as of *constant* occurrence. As I consider this matter of some importance, I subjoin, with the consent of Professor Simonds, a letter I wrote to him on this subject a few months since.

21, Parliament Street,
September 8, 1854.

My dear Sir,

In a conversation with you a short time since, at the College of Surgeons, you told me, to my surprise, that valves had been described in the splenic vein at the London Veterinary College, for some time past. I thought that *I* had made this discovery, for all physiologists, German, French, and English, (as far as I know,) from Hunter downwards, deny the existence of valves both in the splenic and other abdominal veins. Kölliker in his article on the "*Spleen*," *Todd's Cyclopædia*, says, "There are no valves in the splenic vein." Mr. Gray, the gainer of the late Sir A. Cooper's Prize Essay, appears to have been in total ignorance of their presence; and I find that some of your own pupils are equally in the dark respecting them. It is curious, too, that in the communications made by me at the Zoological and Physiological Societies of London, published in the "Lancet," "Medical Times," and "Association Journal," the "Zoologist,"

and many of the Foreign Journals, that no one has spoken of the previous discovery of these valves.

My object, however, in writing is, to ask you to kindly furnish me with the particulars, that I may insert the substance of your reply in my forthcoming book on the Spleen. Have these valves been described at the Veterinary College as constantly present? and if so, in what animals, and by whom?

I have, at the Zoological Society, shown valves in the abdominal veins of several animals; but for the present you will oblige me by confining your answer to the splenic vein; and as your knowledge of Veterinary literature is more extensive than my own, perhaps you will kindly refer me to writers upon the subject.

Believe me, my dear Sir,

Yours very faithfully,

Professor Simonds. EDWARDS CRISP.

Professor Simonds favoured me with a call, and explained that these valves had been found in the splenic vein of the Horse and Ass only. In a subsequent communication, he enclosed the following extract from a paper by Mr. Gamgee, "*Veterinarian,*" December, 1851, p. 679, (some time after my account of these valves was written.)

"The veins returning the blood from the Stomach (of the horse), are the gastric and splenic, which anastamose with the duodenal veins. These all have a few valves, but they may be easily injected from the portæ into which they empty, owing to their being free anastamoses."

The circumstance of especial physiological interest respecting these valves is, that they are only present in animals with large stomachs, as the Ruminants and Kangaroos, or in animals that take a large and frequent supply of vegetable food, as some of the Pachyderms. I have at present never found them in a flesh feeding animal, except in a Mastiff, with a stomach *enormously* enlarged; the food of the animal being chiefly vegetable. The effect of these valves on the course of the

blood of the Spleen, Stomach, and Liver I have elsewhere explained. I have likewise stated, page 167, that I have never found tubercles in the Spleen of an animal with valves in the splenic vein.

My motives for analysing the Prize Essay, and for exposing the glaring and *fundamental* errors of the author and his colleagues, are explained in the Appendix. I ask the reader to look to the provisions of the Will of Sir A. Cooper; to the paper and drawings previously published in the "*Philosophical Transactions;*" to the grant of the Royal Society; to the erroneous analyses; to the number of persons employed in the compilation of the Treatise; and then enquire whether this Essay should have received the prize? Whether it was worthy of the fulsome eulogies passed upon it by the authorities of Guy's Hospital, and by some of the reviewers?

In conclusion, I beg to thank the Council of the Zoological Society, and especially Mr. Mitchell, the Secretary to that Society, for the numerous opportunities afforded me of examining the animals at the Regent's Park Gardens; to the Council of the College of Surgeons I also express my obligations; as well as to Mr. Bartlett,* the Superintendent of the Crystal Palace Zoological department; and to many other friends for their kind aid in procuring me specimens of various kinds.

I scarcely need add, that all the names now mentioned in the work were withheld in the original Essay, and that I was especially careful that the adjudicators should know when I received assistance from others. For explanations respecting abreviations, &c., I again refer the reader to pages 10, 11, and 50.

* The Elephant, Giraffe, and many of the animals described, are in the Crystal Palace.

21 Parliament
Feb 1855.

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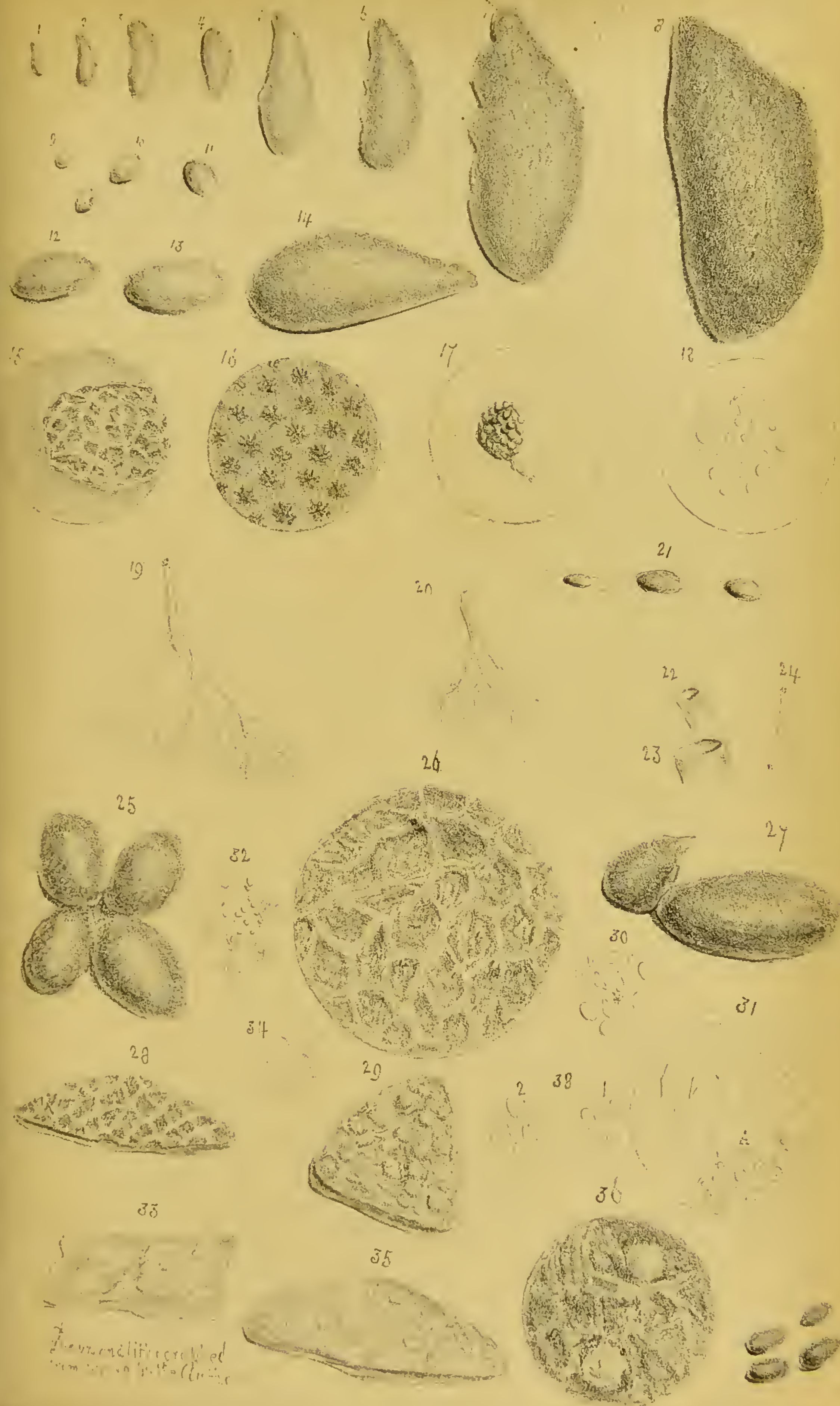
Explanation.—All the drawings in Plate 1 were in the original Essay; in Plate 2, *(Mammals,)* of the 337 figures, Nos. 2, 23, 56, 58, 69, 89, 92, 97, 98, 100, 107, 108, 114, 126, 127, 128, 129, 131, 132.—*Birds.*—Figs. 147, 149, 150, 151, 152, 153, 154, 155, 156, 157, 163, 169, 170, 174, 175, 177, 178, 181, 182, 183, 184, 185, 191, 203, 208, 209, 210, 212, 219, 224, 228, 233, 234, 243, 244, 245, 249, 255, 256, 257, 258, 259, 262, 268, 269, 270, 271, 272, 236, 274, 275, 276, 282.—*Reptiles.*—Fig. 300.—*Fishes.*—Fig. 320, 329.
In Plate 3, specimens 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 18, 19, 20, 24, 25, 27, 28, were only depicted; and in Plate 4, the valves of the Giraffe only figured. These sketches have been selected in preference to some in the original Essay, in consequence of the greater rarity of the animals.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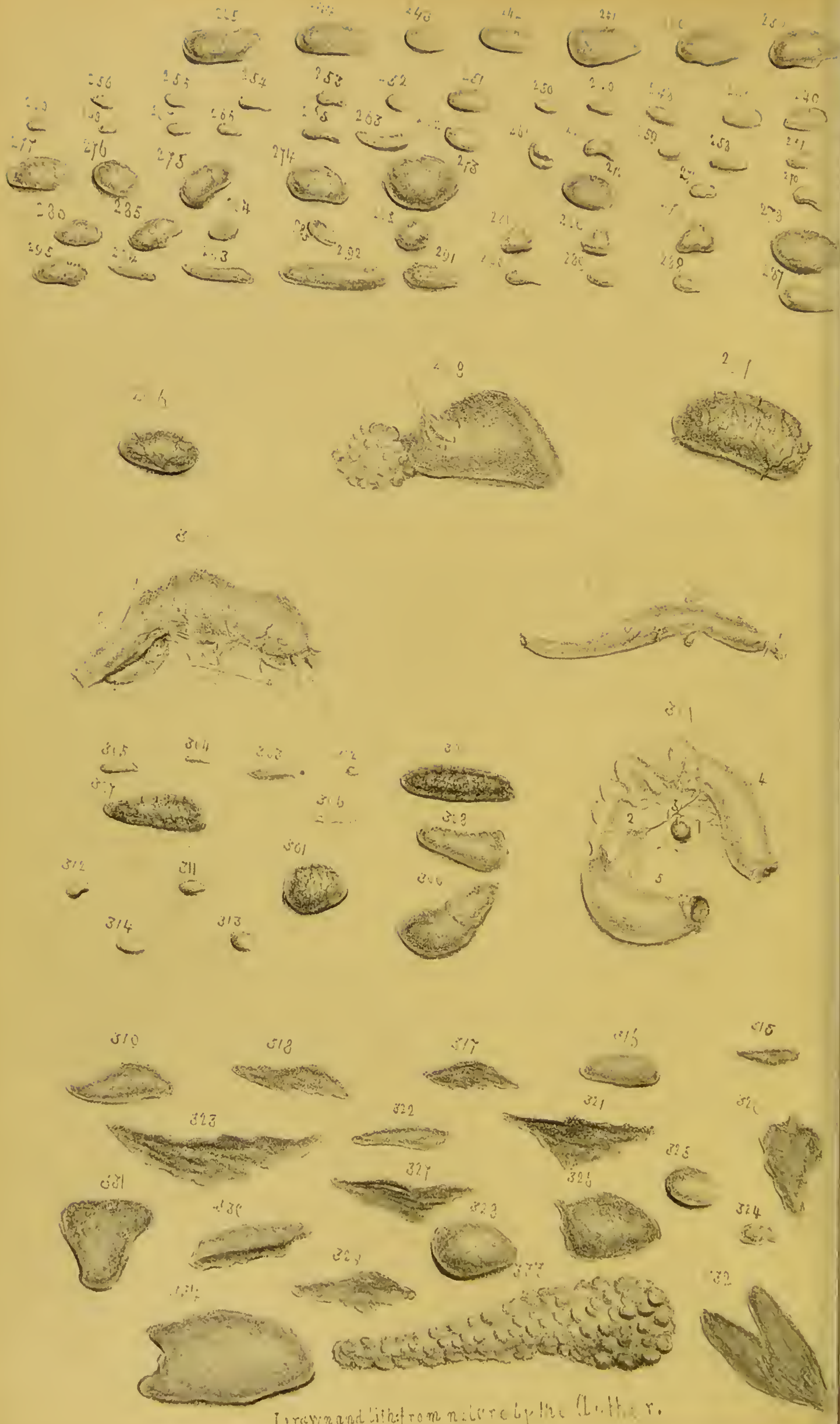

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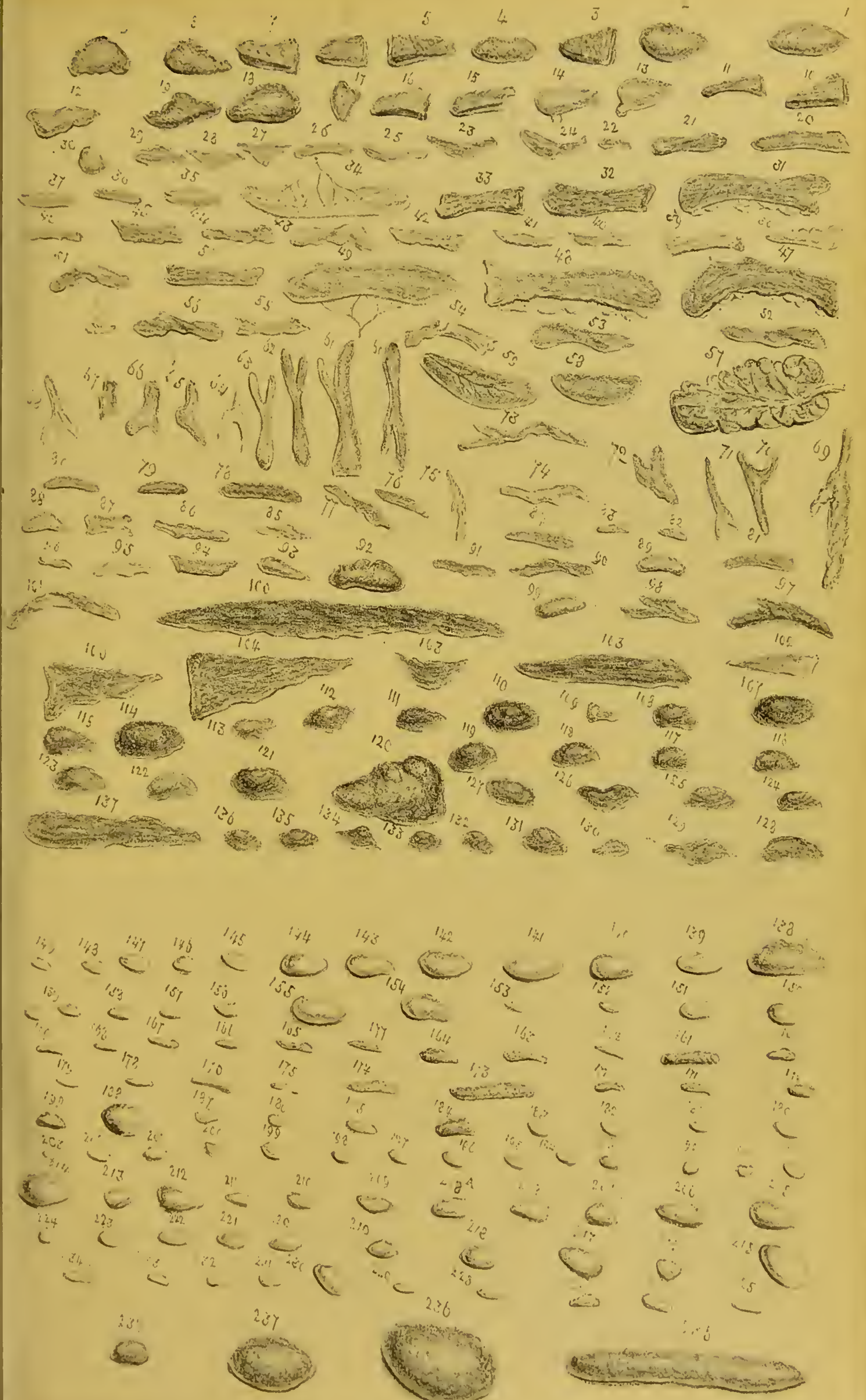
PLATE 2



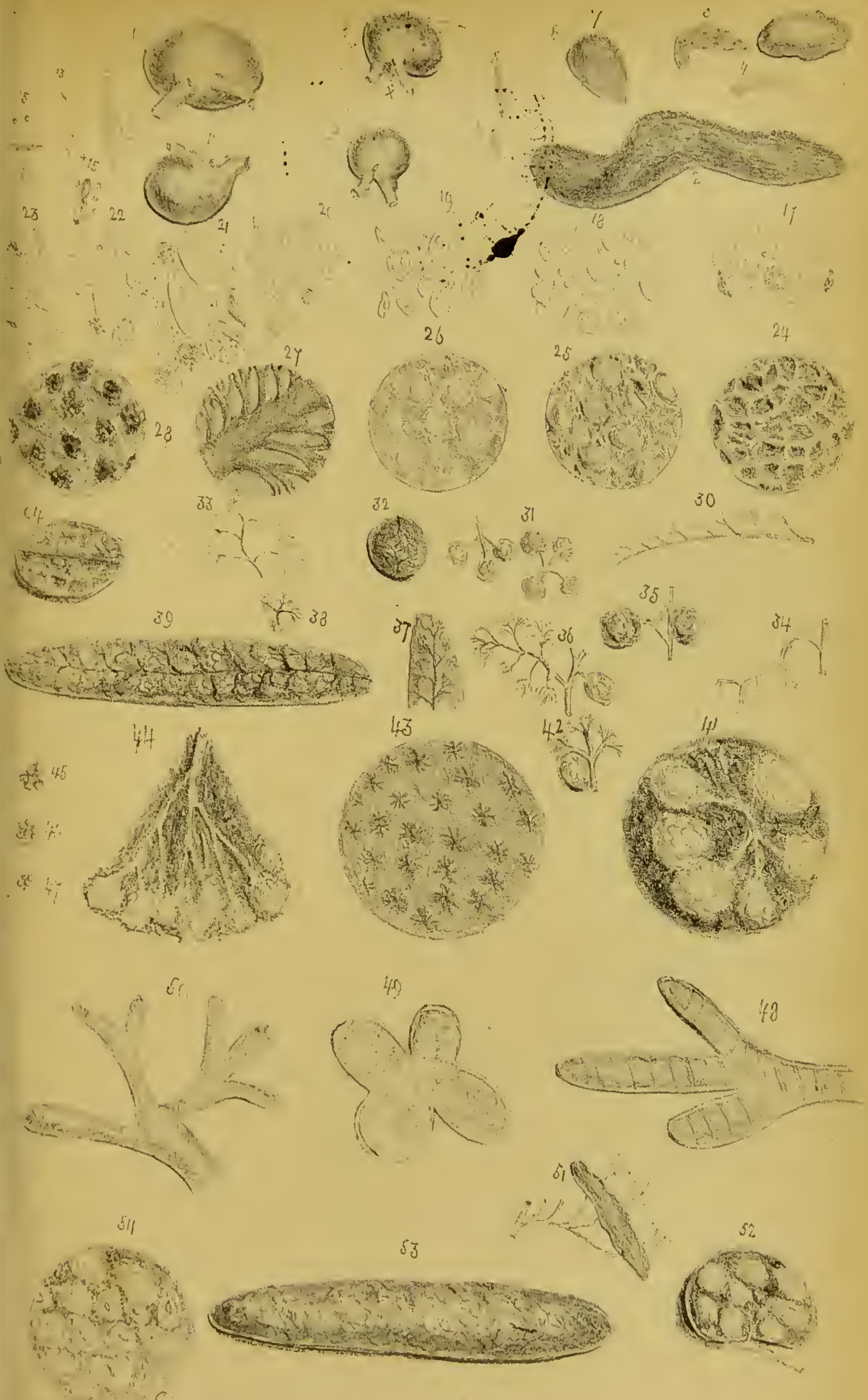


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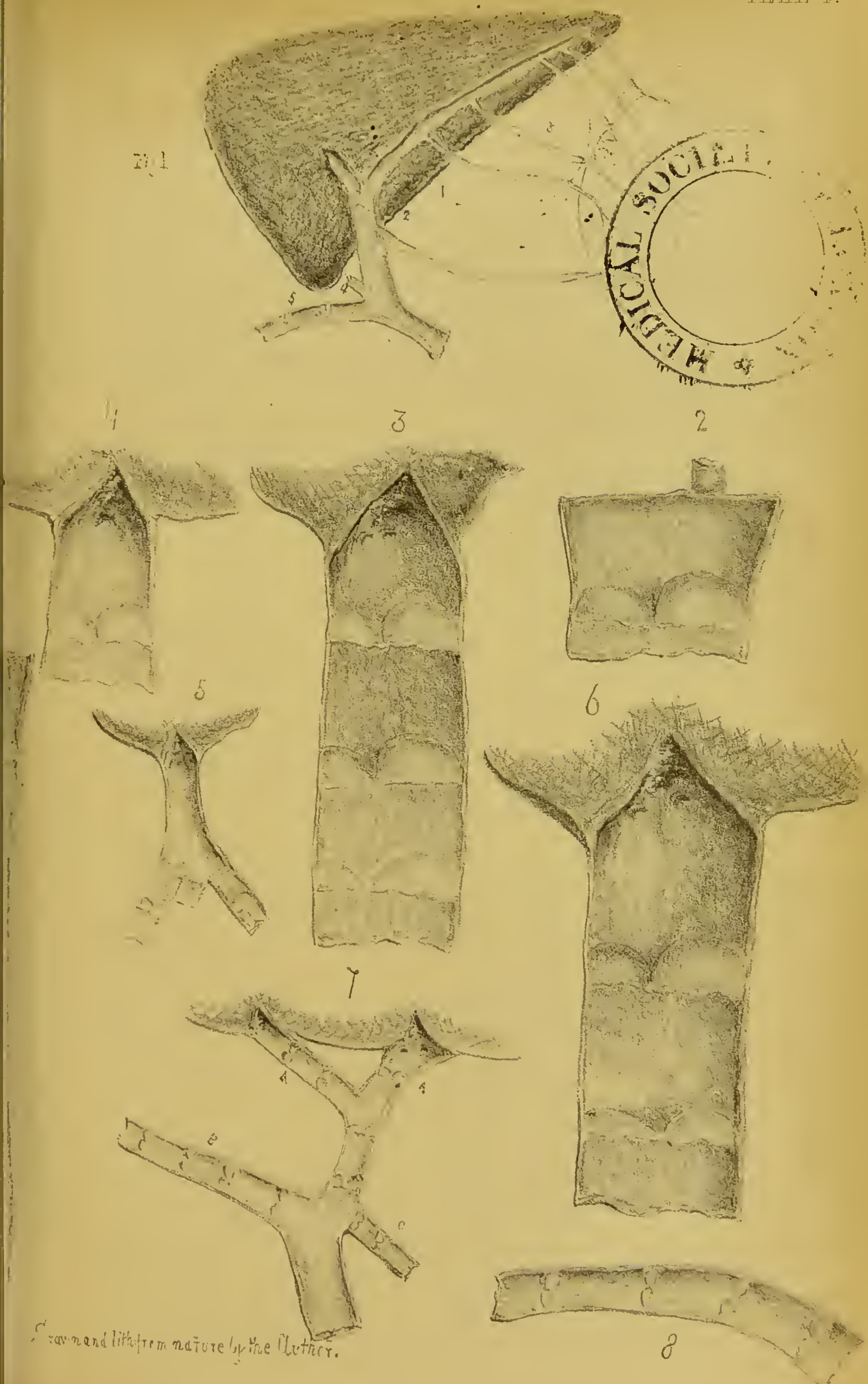
PLATE 4.



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PREFACE.

The investigation which I am about to undertake, is one of so much difficulty, one that has puzzled and bewildered so many who were, perhaps, better competent for the task than myself, that I felt a natural distrust and misgiving at the onset of the enquiry which soon induced me to lay down my pen and relinquish the attempt in despair: the knowledge also that a certain amount of cruelty and destruction of life must attend the investigation, was another motive that led me to abandon my intention. After a few days' reflection, however, I asked myself whether the enquiry, if I did not obtain the prize, might not be attended with some advantage? Whether in the course of my labours, some discoveries might not be made in other branches of physiology, comparative anatomy, and pathology, that might hereafter be brought to good account? and, urged on by this hope, I commence my task of endeavouring to elucidate the "Structure and use of the Spleen," taking for my guiding point and compass, the following directions from the will of the late estimable donor of the Prize:—

> "*That the Essays or Treatises, written for such Prize, shall contain*
> "*original experiments and observations, which shall not have been previ-*
> "*ously published; and that such Essays or Treatises shall (as far as*
> "*the subject will admit of) be illustrated by preparations and drawings.*"

Without further comment I place before the reader the mode of investigation that I have chalked out for myself.

1. Brief introductory remarks on some of the more recent theories concerning the anatomy and functions of the Spleen. 2. Physiological and Anatomical Proem. 3. The Anatomy of the organ in man, and the lower animals. 4. Its weight in comparison with that of the body. 5. The progressive development of

the Spleen in the Vertebrata, and its size as compared with the Liver, Kidney, Pancreas, Heart, Lungs, and Brain. 6. Its size, in relation to the blood corpuscles, the bile, and the urine. 7. Its size in relation to the magnitude of the stomach; the length of the alimentary canal; existence of a gall-bladder; the nature of the food, the quantity of fat, the temperature, muscular power, swiftness and longevity of the animal. 8. The effect of climate on the size, shape, colour, consistence, situation, elasticity, &c., of the Spleen in the various classes of animals. 9. Supplementary Spleens. 10. The state of the Spleen in acephaloid and malformed animals. 11. The supposed cause of the absence of the Spleen in the invertebrate animals. 12. The analogy (assumed) between the Spleen and the glands without ducts:—viz.: the Thymus, Thyroid, and supra-renal capsules. 13. Its supposed resemblance to the Placenta. 14. The effect of extirpation of the Spleen in man and the lower animals. 15. My own experiments respecting the action of medicines, poisons, and injections into the veins; of heat; of cold; abstinence, and repletion. 16. Lastly and especially,—to endeavour to elucidate the physiology of the Spleen, by its morbid conditions in man and the lower animals. 17. General conclusions from the above evidence.

LIST OF PREPARATIONS.

The subjoined is a list of the 243 Preparations (including the microscopic) sent with the Essay. They are frequently referred to in the course of the work. A coloured drawing is also given of the Spleen, and frequently of other viscera. Besides these, about 150 preparations have since been added; the latter are only alluded to in the additional notes. The Drawings and Preparations may be inspected during the next three months by any member of the profession; after this time, they will probably be deposited in some public Museum. They are exactly in the same state as when they were sent to Guy's Hospital. The Pathological Preparations are all marked with blue paint. As the Latin names of the animals are given after the description of each, it is unnecessary to repeat them here.

MAMMALIA.

Bimana.—Preparation 1. Five Fetuses, with the Spleen *in situ*, and seven Spleens (some of them injected), for the purpose of shewing the size of the organ in various stages of fœtal life and infancy. 2. Fœtus in the membranes, about the sixth month, shewing the Spleen. 3. Fœtus (injected with size and vermillion) exhibiting the Spleen *in situ*. 4. Spleen, pancreas, thyroid, and thymus glands, with the kidney and supra-renal capsule of a child at birth, with the weight of these organs. 5 The enlarged Spleen of a soldier, who died of Walcheren fever, injected, and exposed to the action of water, for the purpose of shewing the arterial tufts. 6 and 7. Portions of Placenta treated in the same manner, by way of contrast with the last preparation.

Pathology.—Prep. 134. The Spleen of a Woman covered with fibrinous deposit; the Kidney (affected with Bright's disease) injected. 135. Hypertrophied Spleen of a Child, æt. 2, weighing 8 oz. 137. Slice of a Spleen, weighing 3 lbs. 3 oz., shewing fibrinous deposit. 138. Slice of a hypertrophied Spleen. 140. Portion of hypertrophied Spleen. 142. Spleen curiously divided;

with supplementary Spleen also. 143. Small adult Spleen; one portion injected. 144. The Spleen and Liver of a Child, æt. 2. 145. Hypertrophied Spleen, weighing 3½ lbs. 139. Three supplementary Spleens from different subjects.

Quadrumana.—Prep. 17. Spleen, Stomach, Pancreas, and Kidney of the Orang-outan. 18. The Liver of the same animal. 185. The alimentary canal, distended with air. 19. Spleen of a pig-tailed Baboon, after long immersion in water, shewing the trabeculæ. 20. Stomach and Spleen of a young Monkey. 21. Spleen of Sykes' Monkey. 22. Spleen of a Toque. 23. Spleen of a Macaque. 24. Spleen, stomach, and kidney of a Marmoset, injected. 25. Spleen of a Green Monkey, with aorta and cœliac axis injected. 26. Spleen of a Green Monkey. 27. Stomach and Spleen (injected) of a young Barbary Ape (two months); the animal bred in England. 28. Spleen of a Jos Monkey. 29. Spleen of Moustache Monkey. 31. Spleen of a Mona Monkey, injected. 30. Spleen of a Spider Monkey. 169. Tuberculated Spleen of a Green Monkey. 29. Spleen of a Ring-tailed Lemur. 59. Spleen of a Yellow Lemur. 69. Spleen and stomach of Loris Nycticebus.

Cheiroptera.—Prep. 185. Spleen of a Long-eared Bat.

Carnivora.—Spleens of—32. Grisly Bear. 33. Black Bear. 34. Two Sun Bears (injected). 155. Coati Mondi (injected), tuberculated. 41. Badger. 47. Otter (injected). 45. Taira. 44. Common Fox. 50. Long-eared Fox (injected). 49. Wolf. 43. Civet Cat; the aorta and cœliac artery injected. 43. Ichneumon. 53. Surikate. 35. Old Lion (injected). 36. Old Lioness (uninjected). 37. Old Lion (uninjected). 38. Old Tigress. 39. Old Leopard. 48. Wild Cat, the spleen curiously divided. 46. Serval. 189. Ichneumon. 188. Splenic vein and artery of Lion. 149. A Kitten with two heads, the spleen natural.

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Marsupiata.—Prep. 61. The Spleen and Stomach of a young Opossum. 42. The Spleen of Mauge's Dasyure, partly injected. 60. The Spleen of Ursine Dasyure. 56. The Spleen of a Rock Kangaroo, and of Mauge's Dasyure. 54. The Spleens of two large Kangaroos, one entire, a portion of the other extended for the purpose of demonstrating the attachment of the trabeculæ.

58. A portion of the Spleen of a Kangaroo, injected. 55. The Spleen of the Tree Kangaroo. 57. The Spleen of the Rock Kangaroo. 191. Spleen of a Vulpine Phalanger.

Rodentia.—Prep. 66. Spleen and Stomach of an American Grey Squirrel. 68. Of Common Squirrel. 69. A Dormouse at the hyberuating period, shewing the Spleen and the thymus gland, not increased in size. 190. Spleens of several Rats at various ages. 64. The Stomach and Spleen of a Musquash. 65. Spleen of a Beaver. 70. Spleen and stomach of a Long-tailed Porcupine. 67. The Spleen of an Agouti, shewing beautifully the Malpighian corpuscles. 63. Spleen and stomach of a Jerboa.

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Eighteen specimens of the Bile of the human subject, and one hundred and fifteen of the lower animals, including that of dogs and cats without a Spleen; in relation to the assumption of Kölliker, "that the blood-corpuscles undergo solution in the Spleen, and that their colouring matter is employed in preparing the colouring matter of the Bile."

EXPLANATIONS TO THE READER.

1. That every drawing, every injection, and wet and dry preparation, microscopical or otherwise, accompanying this treatise, has been made by the author.*

2. That every *post mortem* examination of man and of the lower animals has been performed by the author, who has weighed the organs himself, and in no instance has he depended upon the testimony of another.

3. That a paper, like the one accompanying this sheet, has always been filled up at the time of the dissection; and the author has not allowed himself to depend upon his memory. If the weight has not been noted at the time, the figures in that column have been omitted.

4. That every coloured drawing taken by the author has been from the recent parts, and by rule and compass.

5. That the object in these sketches (many of them rough) has been to give the colour and shape of the organs, and often to show the Spleen in connexion (contrast) with the other viscera.

6. That every gall-bladder has been painted with the bile of the animal, the sides being shaded with Indian ink. That the blood of the animal dissected is placed upon the paper, when the blood of the splenic vein and artery is examined for the purpose of contrast.

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* Except those *figures* marked †, which a non-professional friend has kindly executed when the author has been pressed for time; and Preparation 5.

7. That the weights of the larger organs have generally been taken with steelyards, accurately tested.

8. That, when the weight* of the Spleen has been very small (¼ of a grain *e.g.*), it has been guessed at, the author believing that, from the constant practice of weighing the different viscera, his estimates are tolerably correct. In weighing an organ, *if large*, the exact weight in grains has not been noticed; but in all small organs the utmost accuracy has been observed.

9. That the microscopic drawings (especially of the blood corpuscles), were at first taken with the steel disc, but that latterly the author, from constant practice, has dispensed with this mode of delineation.

10. That the microscope used is one of Ross's; the lenses chiefly employed being the one-inch, quarter-inch, and eighth; a circumstance necessary to bear in mind for the sake of comparison.

11. That the microscopic observations have, for the most part, been made by sun-light, a wax candle, or gas-light, with a screen of white silk (very thin.)

12. That there are some sources of fallacy of which the reader should be reminded; 1st, as regards the measurement of the intestines, which sometimes readily pull out through the mesentery, and thereby become longer than when this part is simply cut close to the bowel and then elongated; 2ndly, that many of the animals examined were not living in a state of nature, and that, therefore, erroneous inferences might be drawn respecting the normal weight of their viscera; but to obviate this objection, the cause of death (or the supposed cause) is always given, and in the prosecution of this inquiry, the author has invariably endeavoured to ascertain the cause of the death *himself*.

13. The *Cuvierian* arrangement of animals is adhered to throughout.

If the reader will keep his eye upon the heading of the columns, which include country, food, age, cause of death, weight of viscera, and length of body and intestines, with presence or absence of gall-bladder, reference to plates and figures, and state

* Avoirdupois is always used; and when the part is under an ounce, the weight is expressed in grains (Troy), 440 of which make the ounce Avoirdupois, and 7,040 the pound.

of Spleen, he will have no difficulty in understanding the arrangement and in drawing his inferences.

The length of the body is often given in the same column with the length of the intestines, and the various classes of animals are measured in the following manner:—The alimentary canal, always from mouth to anus; the body of quadrupeds, from nose to anus; of birds, from root of neck to anus, (the variations in the length of the neck rendering this necessary); reptiles, from nose to anus; serpents and fish, from nose to root of tail.

Throughout the treatise, the object aimed at has been *conciseness*, and to save the time of the reader, by referring him to drawings and preparations, and when practicable, an outline of the case, or a description of the morbid parts, is given under the drawing.

INTRODUCTION.

Although thousands of pages have been written on the Anatomy and Physiology of the Spleen, there is not one investigator, that I am acquainted with, who has taken a broad and comprehensive view of the subject. The labourers in this field of investigation have for the most part confined their researches to the examination of the Spleens of a few animals—those of man, the ox, sheep, horse, dog, cat, rabbit, and guinea-pig, being the principal.

Another great omission, I think, in previous enquiries, has been the neglect of pathology and morbid anatomy, as a means of elucidating the physiology of this organ; and, I believe, that no separate work exists at present on the Pathology and Morbid Anatomy of the Spleen, notwithstanding the important bearings its abnormal conditions have on the functions of the body. *Rokitansky, Andral, Cruveilhier, Piorry, Twining, Bree, Bright*, and many others, have written upon the diseases of the Spleen, but their enquiries have been confined entirely to human pathology, and the diseases of the lower animals have been altogether neglected; indeed, even among veterinary works, I am unable to find one which treats upon the disorders and diseases of the Spleen; so much has this department of pathology been neglected. It is true that facts of great interest and importance are scattered about in various Journals, but no one, (so far as I know,) has yet attempted to collect these, and to draw physiological deductions from them.

Nearly all the important discoveries in physiology have been made by experiments upon living animals in a state of health, but why should not their diseased conditions be turned to account? Why may not brute pathology hereafter clear up some of the doubts and difficulties of our art? The examination of one of the lower animals that has been kept in confinement is attended with these great advantages. The exact nature of the food, and the deviations from the natural state of the animal, can be readily ascertained; and if the animal is small (a bird *e. g.*), all the morbid parts are revealed at once, and the chain of causes more apparent than in larger animals; the investigator always taking into account the peculiarities of structure of the animal.

Pathology has thrown much light upon some of the functions of the human body; many lesions of the brain and nervous system tend to reveal the office of these parts; and not unfrequently the examination of morbid structures has elucidated their physiology.

If the diseases of the Spleen, according to the present state of our knowledge, do not shew clearly its office, they at any rate convince us that many of the theories respecting its use are based upon assumption, and not upon evidence obtained by the scalpel and the microscope.

If the reader should think that I do not allude so frequently to the works of others as they deserve, my reply is, that my mode of investigating the subject differs from that of all who have preceded me;—that my dissections of animals (for this particular object), have been so numerous, that I feel myself entitled to depend chiefly upon my own observations, and I do so the more readily, because I believe *that it was the intention of the late Sir Astley Cooper, that the gainer of the prize should draw his conclusions chiefly from his own experiments and observations, and that he should depend as little as possible upon the labour of others.*

The above remarks may savour somewhat of arrogance and conceit; but I express exactly what I feel, and I leave the reader to condemn me if he please. The subject is one that *should* teach me humility;—it has raised my wonder and admiration of the works of nature, and of the goodness and beneficence of her *Great Architect;* and if in the following pages any dogmatical expressions escape me—if I have hinted at any assumption of superior knowledge—I now at once disclaim such a feeling, *and confess that I have scarcely reached the threshold of the inquiry;* scarcely escaped from the cloud of darkness that still enshrines this mysterious subject; and if I endeavour to lift the veil of error from the pages of others, it is not without a feeling, that much may encumber my own. I have, I hope, like others who are engaged in this interesting enquiry, endeavoured to carry it out in a spirit of candour and truth; and although my views may be altogether different from some of those whose position entitles their opinions to much attention, I give them credit for possessing the same honesty of purpose that I claim for myself.

It would be useless to tire the reader with a recapitulation of

the opinions of the various writers from the time of *Hippocrates* to the present period, on the functions of the Spleen: such a description may be found in the works of other authors; and bibliographical notices * can be referred to in the numerous Dictionaries and Cyclopædiæ. As I aim at *brevity and originality,* it will suffice, I think, if I give the sum and substance of the opinions of three of the most recent writers on the *Anatomy and functions* of the Spleen. This method will save the reader trouble, and will enable him to ask himself this question: How happens it that men who have used the microscope with great patience and perseverance for many years, arrive at such opposite conclusions? That one sees *black,* and another *white?* that the hues of the chameleon are not more varied than the descriptions of "molecules, corpuscles, granules, vesicles, free nuclei, compound granular cells, oil and fat globules, colourless nucleated blood cells, colourless corpuscles, pus globules, lymph globules, molecular bases, fibrillated fibrin, fusiform corpuscles, sacular corpuscles, sacular cells, parenchyma cells, aggregated particles, &c. &c."

Would that we could reconcile the various discrepancies that exist, under the supposition that the same things are called by different names—that the fault is in the nomenclature—not in the observer and his instruments. But allowing that microscopic descriptions are often indefinite and faulty, we cannot overcome the difficulty—we cannot contradict the statement—that men whose eyes are equally good—whose powers of discrimination and love of truth are not to be doubted, look at the same object—but unlike the travellers in the fable, see different forms, if not different colours. What better illustration of this can be given than the recent conclusions of Dr. H. Bennett and Kölliker on the functions of the Spleen? The former believing it to be a *blood-forming* organ, whilst the latter asserts that it is *blood-destroying.*

The article in the "Cyclopædia of Anatomy and Physiology," p. 771, is one that demands especial attention, because parts of it are copied already into our students' books (Ellis's Anatomy, 1852), and the Essay on the Spleen, in Copland's Dictionary (just out, 1852), is an epitome of that of Kölliker.

* In the paper by Mr. Sanders, hereafter alluded to, is a good account of the Bibliography.—*After note.*

I give a brief abstract of the important parts of this article, leaving the reader to refer to the original if he choose. It must be observed that Kölliker endeavours to substantiate his opinions by frequent reference to the works of others.

1st. Concerning the exterior surface of the Spleen and its trabeculæ. " That muscular fibres are not present in the fibrous coat of the human subject, although they are in some of the Mammalia, and most visible in the dog and pig; also present in the cat, ass, and dycotyles torquatus, but absent in the rabbit, horse, ox, hedge-hog, guinea-pig, and bat" (p. 772.) " That the trabeculæ of the human Spleen completely correspond with that of the fibrous tunic (consisting of white fibrous tissue and yellow fibres). That muscular fibres in the trabeculæ of the pigeon are very distinct, combined with the elastic tissue, and that they are found in the dog, ass, cat, dycotyles torquatus, sheep, rabbit, horse, hedge-hog, guinea-pig, and bat. That in the human Spleen questionable structures are found (p. 774), the nature of which future enquirers must determine. That the Malpighian bodies occur in the Mammalia as in man (judging from the examination of twenty genera); are seen in sparrows, but are not particularly distinct; in the *Anguis-fragilis,* but not in the naked Amphibia and in fishes; here and there in toads and frogs. That the conclusion of Müller, that they exist in all the vertebrata, is incorrect. That these corpuscles possess a *special* membrane, which contains white fibrous tissue and elastic fibres; that their contents are the same as the Spleen-pulp; that their essential elements are cells, with a single nucleus of a *spherical* shape, with nuclei, and larger cells with one or two nuclei; that plainly and *definitely these corpuscles (Malpighian) are closed corpuscles, and stand in no relation at all to the lymphatics* That they are not glands in the ordinary sense, but might be regarded as glandular vesicles."

" *Spleen-pulp.* That smaller and larger corpuscles occur in this, which are not met with in the Malpighian corpuscles, and that free nuclei are more numerous. That the elements of the pulp vary greatly. That in the Amphibia the Spleen has often (not always) beautiful parenchyma cells, with large nuclei. In birds and the scaly reptilia, granulated, and somewhat dark; in the

hedge-hog, rabbit, and guinea-pig, some peculiar cells; some with three, four, or ten nuclei, forming a mulberry-like mass."

"But the pith and marrow, the practical and essential part of the Essay consists in the opinion (contrary to that of Gerlach) that the blood corpuscles *undergo dissolution in the Spleen, and that their colouring matter is employed in preparing the colouring matter of the bile:* supported by the supposed facts, that the Spleen-pulp of man and animals varies at different times, without any alteration of the other constituents; the variations of red, brown, or black, depending upon the different changes in the blood-corpuscles, which ultimately become pigment granule cells; often colourless cells. The cells in mammals, not easily seen, on account of the small size of the latter, &c.,; but they have been seen by Kölliker (of whom I speak) plainly in man, the rabbit, guinea-pig, sheep, calf, and dog; the number of included blood globules being from one to twelve. In birds, in the *Falco Albicillus, Cuculus Canorus, Turdus varius, Perdix saxatilis,* and *Sylvia Hortensis.* In the scaly reptiles, in *Anguis fragilis,* and *Coluber Austriacus,* no cells with unchanged blood-globules were found; but in the naked Amphibia, (frog, &c.), these cells are better seen than in any animals. In fishes, the same, but not so brilliant, and all converted into colourless granules, and partly into black pigment cells, and pigment masses, which finally, often lose their colour. That the *place* where these changes occur can be demonstrated in some Amphibia, *(Triton igneus),* to be in the blood-vessels; pouchings of the same, like false aneurism, (p. 784). In the scaly reptiles, mammals, and birds, it is difficult to say in what part of the Spleen, the formation of the cells which contain the blood corpuscles and their metamorphoses occurs." That in fishes all the blood-globules may be recognised as decomposing; that in all animals, after fasting, the decomposition of the blood corpuscles occurs only to a small extent."

"That the splenic artery contains three coats, and that the middle tunic consists of little else but unstriped muscular fibre; but in the larger, and largest arteries, elastic fibre, and elastic membrane are also present. That the branches of the splenic artery form no anastomoses." "That the veins of the Ox possess only a

tunica intima, in the shape of a delicate epithelium, so that one may speak of them as *venous sinuses,* but no special cells, nor cavities exist."

"Whether the Nerves terminate in loops or free extremities is doubtful; and that the *uncommon* size of the nerves of the ruminant depends upon the excessive development of the fibres of Remak."

"That the lymphatics of the Spleen in man, terminate in the thoracic duct near the twelfth dorsal vertebra; that the lymphatics of the interior belong exclusively to the sheaths of the vessels; that they are only sparingly present in the interior of the spleen, (p. 793), and that they play a subordinate part."

"*That no proof of the formation of the blood-corpuscles in the Spleen exists, but on the contrary, the blood-corpuscles undergo solution in the Spleen, and that their colouring matter is employed in preparing the colouring matter of the bile." (p. 797).*

I have endeavoured to place before the reader a *resumé* of Kölliker's views; which he has given, apparently with great candour and impartiality. For a more extended notice, I refer to the book itself.

Dr. H. Bennett, of Edinburgh, in his work recently published (1852) on *Leucocythemia,* or White-cell-Blood, says in his preface, "In this Memoir I have described numerous examples of a remarkable alteration of human blood, which hitherto has always been found associated with a morbid condition of the Spleen, or other glands of the Lymphatic System. The general conclusion to which my observations have led is, that these glands secrete the blood, a circumstance which, if physiologically true, must lead to a more correct knowledge of the pathological relations existing between the one and the other. Further enquiry into this important subject demands the co-operation of that now numerous and earnest band of labourers who are investigating the blood histologically, in conjunction with the Clinical History of Disease."

In opposition to the opinions of Drs. Williams, Addison, and Mr. Wharton Jones, he believes "that the white corpuscles, so far from being increased in inflammation, are diminished. That in *leucocythemia* the red corpuscles are often crowded together in the

manner described by Mr. Jones, but that persons in this condition have no universal inflammation. That in one instance of *leucocythemia* the fibrin was increased to 7.08 in 1000, and in another to 6.0 (p. 114.) That no difference can be detected between the pus globule and the white-blood globule; that laudable pus produces no ill effects when circulating with the blood. That under certain circumstances the growth of cell elements may be increased in the lymphatic glands."

Dr. Bennett records twenty-five cases of *leucocythemia* occurring chiefly in the practice of others, and extracted from various sources. In nineteen of these the body was examined; to these he adds seven cases recorded by Dr. Hodgkin of enlargement of the Spleen and lymphatic glands, and two cases of enlarged Spleen examined after death, and where no *leucocythemia* existed.

In the thirty-two dissections the organs most uniformly diseased were the Spleen, the Liver, and the Lymphatics. In nineteen cases of *leucocythemia,* in which the body was examined after death, the Spleen was more or less enlarged in sixteen. In one, more compact than usual, in another healthy, and in a third the condition is not named.

Dr. Bennett admits that in numerous cases of enlarged Spleen it has been proved, by careful examination, that the blood was normal. (p. 93.) Of the above nineteen cases, the liver was diseased in thirteen; in six healthy, in one its condition is not noticed; the lymphatic glands were more or less diseased in eleven.

But the sum and substance of Dr. Bennett's conclusions may be comprised in a few words, viz.: "That the white blood corpuscles depend upon enlargement of the Spleen, thyroid, thymus, pituitary, pineal, and lymphatic glands; and that these organs resemble each other in their fibrous stroma, colourless cells, nuclei and molecules, in all stages of development. That the corpuscles of all these glands resemble one another, the slight difference depending upon the degree of development. That they have no excretory ducts, and that the corpuscles, to leave the organ where they originate, can only do so through the lymphatic veins. That when these glands are hypertrophied, their corpuscular elements are increased. That it is certain that the blood of the portal and splenic veins is always richer in white corpuscles

than that of the systemic circulation. That the Spleen is a *blood-forming organ.*" I must refer the reader to the book itself for further information on this interesting subject.

Dr. W. R. Sanders, in the "Annals of Anatomy and Physiology, Edinburgh, 1852," terminates his paper on the Anatomy and Physiology of the Spleen with the following conclusions:—

"1. That the Spleen is a secreting organ; the malpighian sacculi and the pulp being the secreting apparatus, and showing all the essential elements of glandular structure. 2. The circulation of the blood in the Spleen is distinguished by the shortness of its circuit, produced by sudden transition from large to small vessels. 3. The secretion of the Spleen is probably some albuminoid material. 4. The veins, which are of large size, in great number, and peculiarly dilatable, probably absorb the secreted product and carry it into the circulation. They would thus have considerable analogy to the umbilical vein, which further agrees with the splenic, in belonging to the portal circulation. It is probable that the portal circulation performs a function of nutritive absorption. 5. There is a deficiency of anatomical proof that the lymphatics are the excretory ducts of the Spleen. 6. There is a close analogy, both of origin and structure, between the Spleen and the thyroid, thymus, and supra-renal bodies."

Now, that my notes, drawings, and preparations are before me, I shall comment upon the conclusions of these writers as I proceed with my subject, and point out the differences between us; and my remarks will, I think, be of the more value on account of the determination I made at the onset of the inquiry, of avoiding all books and writings upon the structure and use of the Spleen, until I had drawn my own conclusions. I determined to judge for myself, not to be guided by the opinions of any one. I came to this conclusion in consequence of the numerous and palpable errors I had met with, of writers who manufacture articles on anatomy and zoology, without having examined the animals they describe. I could give numerous instances of these loose and careless statements. Mr. Rymer Jones, in his article on the *Solipeda,* in the "*Cyclopædia of Anatomy and Physiology*" (p. 737), says, "the average weight of the horse's spleen is 12 oz., and that

of the liver, between 4 and 5 lbs." I have carefully weighed the spleens and livers of horses, and taking the average weight of seventy-six horses' Spleens (excluding cobs and ponies) I find it to be 3 lbs., 10 ozs. (58 ozs.)! and the statement respecting the weight of the liver is equally erroneous.

Mr. Lawrence, in his translation of "Blumenbach's Physiology" (p. 197), says, "The Spleen gradually diminishes in size from mammalia to fishes." But the Spleen of many fishes (grey mullet *e.g.*) is larger, in proportion to the size of the body, than it is in most birds and quadrupeds.

I only allude to the above assertions to remind the reader that if such loose and careless statements are made by gentlemen of good repute, about matters that common industry and observation would put beyond a doubt, that we should distrust the correctness of the microscopic conclusions of many, who speak with certainty upon structures which are not weighed by scale and balance, but too often by the imagination of the gazer.

I am anxious that the reader should not suppose that I underrate the use of the microscope in physiological and pathological investigations; I have worked hard and long at it, as my drawings and preparations will show; but I look *now* with great doubt and uncertainty upon many objects; and doubt, often, whether a cell is nucleated or not? Whether what appears to be a cell containing globule, is not merely an aggregation of cells with albuminous union? Whether the acetic acid and other chemical agents may not alter materially the normal character of these delicate structures? and whether slight pressure, or partial injury of the Spleen, after death, may not produce some of the changes observed in its substance?

These are doubts which must, I think, cross the minds of all investigators; and when, what were until recently considered fat globules, and which (as I have seen), cannot, under the microscope, be distinguished from them, are made to vanish by the application of hydro-chloric acid; when caudate cells, which were thought to be characteristic of malignant structures, are found to be frequent in non-malignant growths—when the most able investigators come to opposite conclusions respecting the same object—we

have a right to ask whether microscopical inference (judging from published reports) respecting the functions of the Spleen, has not made the matter more obscure than formerly?

One word in conclusion respecting the microscope, which may tend to account for some of the discrepancies. The same objects seen under different instruments do not present the same appearance; and a French microscope (generally used by Dr. H. Bennett), or a German instrument, may show blood corpuscles and granular cells that Ross's does not exhibit.

I make the above remarks in consequence of having used Overhaeuser's instrument before I began this inquiry, and of having tested it by the side of one made by Ross of London.

ANATOMICAL AND PHYSIOLOGICAL PROEM.

Before giving an outline of the structure of the Spleen, let us take a glance at the various orders of vertebrate and invertebrate animals, remarking chiefly upon such peculiarities of structure and function, as may bear upon the subject of this Essay. But as the anatomical differences in the vertebrate animals, will be described under each chapter, it is unnecessary especially to allude to them here, but rather let us speak of some general matters that could not appropriately be discussed in the divisions alluded to.

I select the subjoined from the table which includes the weights of 243 Human Spleens, 19 Quadrumana, 6 Chieroptera, 48 Carnivora, 12 Marsupiata, 41 Rodentia, 128 Pachydermata, 19 Ruminantia, 154 Aves, 17 Reptilia, 21 Pisces.*

Bimana.—In a man 5 feet 8 inches in height, weighing 10 stone (140 lbs.), probably the average weights of his viscera is about the following:—Spleen 6 ozs., Liver 54 ozs., Kidney 4½ ozs., Pancreas 2¼ ozs., Heart 9 ozs., Lungs 56 ozs., Brain 49 ozs., length of Alimentary Canal 30 feet.

In four Adults, whose Alimentary Canals I have measured, the first was 26 feet 5 inches,—second, 28 feet 8 inches,—third, 23½ feet,—fourth, 36 feet 2 inches.

In a child at birth, I find the following to be the weight of the viscera,—Spleen, 100 grs; Liver, 4½ ozs.; Pancreas, 30 grs.; Heart, 225 grs.; Lungs, 3¼ ozs.; Length of Body, 18 inches;—of Alimentary Canal, 14 feet 1½ inches. In four other children, from seven to nine months old, whose intestines I have measured, the Alimentary Canal was 15 feet 9 inches—14 feet 3 inches—16 feet 3 inches, and 13 feet 3 inches. Another at eight months, 16 feet 5½ inches. Another at five years, 25 feet; the length of the body being 3 feet 4 inches.

In a new born fœtus, about the eighth month, now before me, weighing 6¼ lbs., the Spleen weighs, 120 grs.; Pancreas, 49 grs.; Thyroid gland, 17 grs.; Thymus gland, 117 grs.; and the Kidney

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* Besides these, many animals, in spirit, in the College Collection (Store), have been weighed, and the Spleens figured, and the weight of the organ estimated; but irrespective of form, the author does not attach much importance to these examinations.

and supra-renal Capsule, 180 grs. These organs are all seen in preparation No. 4. The Spleen, Plate 1, fig. 8.

Quadrumana.—From these I select the *Ourang-Outan, (Simia Satyrus, Asia)*, a young animal that died of diarrhœa, and was otherwise free from disease, as all the viscera (Prep. 17, 18, and 185), shew. Weight of animal, 19½ lbs. Spleen (it has not been separated from the stomach), *about* 1 oz.; Liver, 14 ozs, 80 grs.; Pancreas, *about* 90 grs.; Kidney, 1 oz. 22 grs.; Heart. 1 oz. 256 grs.; Lungs, 2 ozs. 340 grs.; length of Alimentary Canal, 17 feet 7 inches.

Spider Monkey, (Ateles, South America.)—Weight, 4 lbs.; Spleen, 73 grs.; Liver, 3 ozs. 10 grs.; Kidney, 128 grs.; Heart, 325 grs.; Lungs, 1 oz., 10 grs.; length of Alimentary Canal, 8 feet 1 inch (Prep. 30).

Barbary Ape, (Macacus Innus, Gibraltar.)—Two months old, born in England; weight, 16 ozs.; Spleen, 40 grs.; Liver, 1 oz.; Kidney, 48 grs.; Heart, 55 grs.; Lungs, 130 grs.; length of Alimentary Canal, 5 feet 11 inches. (Prep. 27).

Loris Nycticebus.—(East Indies). Weight, *about* 16 ozs.; Spleen *about* 60 grs.; (see Prep. 69) Liver, 395 grs.; Kidney, 47 grs.; Heart, 50 grs.; Lungs, 91 grs.; Alimentary Canal, 8 feet; length of Body, 10 inches. Animal young, and in poor condition. (*a.n.*) (Prep. 69)

Cheiroptera.—Common Bat. *(Vespertilio murinus, Europe.)* Weight, 132 grs.; Spleen, ½ gr.; Pancreas, 1 gr.; Heart, 1½ grs.; Lungs, 2 grs. (Prep. 185.)

Carnivora.—Lioness. *(Felis leo, Africa.)* Weight, 268 lbs. (I had this animal weighed in my presence.) Spleen, about 7 ozs.; (Prep. 37); Liver, 4½ lbs.; Pancreas, 2 ozs.; Kidney, 6 ozs.; Heart, 16 ozs.; Lungs, 2 lbs. 10 ozs.; Brain 8 ozs.; Length of body, 4 ft. 11 ins.; of Alimentary Canal, 27 ft. 4 ins. (Prep. 37.)

Insectivora.—Hedge hog. *(Erinaceus Europeus.)* Weight, 16 ozs.; Spleen, 23 grs.; Liver, 480 grs.; Kidney, 45 grs.; Heart, 48 grs.; Lungs, 62 grs.; length of Alimentary Canal, 7 ft. 3 in.

Phocidæ.—Seal. *(Phoca vitulina, Europe.)* Weight, *about* 318 lbs.; Spleen, 17 ozs; Liver, 4 lbs. 8 ozs.; Pancreas, 2½ ozs.; Kidney, 5½ ozs.; Heart, 20 ozs.; Lungs, 2 lbs. 2 ozs.; Alimentary Canal, 76 ft.; Body, 4 ft. 7 ins. (Prep. 40.)

Marsupiata.—Kangaroo. (*Macropus Major, Australia.*) Weight, 37 lbs.; Spleen, 2 ozs. 60 grs.; Liver, 20 ozs.; Kidney, 2 ozs.; Heart, 7 ozs.; Lungs, 12 ozs.; Alimentary Canal, 27 ft. 6 ins. (Prep. 56.)

Rodentia.—Hare. (*Lepus timidus, Europe.*) Weight, 5 lbs. 12 ozs.; Spleen, 20 grs.; Liver, 480 grs.; Lungs, 380 grs.; Length of Alimentary Canal, 13 ft. 11 ins.; of Body, 20 ins.

Pachydermata.—Zebra. (*Equus zebra, South Africa.*) Weight, 10 cwt. (*about*); Spleen, 21 ozs.; Liver, 12 lbs. 2 ozs.; Heart, 3 lbs.; Lungs, 3½ lbs.; Length of Alimentary Canal, 67 ft. (Prep. 73.)

Ruminantia—Giraffe. (*Cameleopardalis, Africa.*) Weight, about 16 cwt., (1,792 lbs.); Spleen, 28 ozs.; Liver, 12 lbs.; Pancreas, 5 ozs.; Kidney, 1 lb. 12 ozs.; Heart, 5 lbs.; Lungs, 10 lbs.; Alimentary Canal, 254 ft. (Preps. 12, 76, 77.)

Aves. Accipitres.—Condor. (*Vultur-gryphus, South America.*) Weight, 13 lbs. Spleen, 45 grs.; Liver, 1760 grs.; Pancreas, 58 grs.; Kidney, about 90 grs.; Heart, 660 grs.; Alimentary Canal, 6 ft. 3 in. (Prep. 107.)

Passerinæ.—Sparrow. (*Fringilla domestica, Europe*) Weight, 410 grs.; Spleen, ¾ gr.; Liver, 15 grs.; Kidney, 5 grs.; Heart, 5 grs.; Lungs, 3 grs.; Alimentary Canal, 10 in. (Prep. 101)

Scansores.—Grey Parrot. (*P. erythacus, Africa.*) Weight, 10 ozs. 105 grs.; Spleen, 2½ grs.; Liver, 201 grs.; Heart, 102 grs.; Lungs, 100 grs.; Alimentary Canal, 42 in. (Prep. 98.)

Gallinæ.—Cock. (*P. Gallus, Europe.*) Weight, 5 lbs. 4 ozs. Spleen, 170 grs.; Liver, 1420 grs.; Pancreas, 51 grs.; Kidney, 400 grs.; Heart, 280 grs.; Alimentary Canal, 7 ft. 10 in. (Preps. 104 and 109.)

Grallæ.—Common Heron. (*A. cinera, Europe.*) (Shot.) Weight, 3½ lbs.; Spleen, 12 grs.; Liver, 620 grs.; Kidney, 85 grs.; Heart, 180 grs.; Lungs, 326 grs.; Alimentary Canal, 114 in. (Prep. 89.)

Palmipedes.—Pelican. (*P. onocrotalus, Europe.*) Weight, 11 lbs.; Spleen, 39 grs.; Liver, 2640 grs.; Pancreas, 100 grs.; Kidney, 780 grs.; Heart, 1380 grs.; Lungs, 240 grs.; Alimentary Canal, 12 ft. (Prep. 85.)

Reptilia.—(*Boa Constrictor, Africa.*) Weight, 30 lbs.; Spleen, 280 grs.; Liver, 19 grs.; Alimentary Canal, 15 ft. 3 in.; length

of Body, 11 ft. 3 in. (Prep. 120.) No. 2. Weight, 7 lbs. 11 ozs.; Spleen, 20 grs.; Liver, 1260 grs.; Kidney, 60 grs.; Heart, 104 grs.; Alimentary Canal, 6 ft. 6 in. (Prep. 119.)

Chameleon. *(C. vulgaris, Africa.)* Weight, 680 grs.; Spleen, about $\frac{1}{4}$ gr.; Liver, 15 grs.; Kidney, 2 grs.; Heart, $2\frac{1}{2}$ grs.; Alimentary Canal, 11 in.; Body, 6 in. (Prep. 126.)

Pisces.—Salmon. *(S. salar, Europe.)* Weight, 126 ozs.; Spleen, 100 grs.; Liver, 880 grs.; Heart, 90 grs.; Alimentary Canal, 30 in.; Body, 24 in.—Grey Mullet. *(M. cephalgus, Europe.)* Weight, 10 ozs ; Spleen, about 30 grs. (Prep. 132.)—Gurnard. *(T. cuculus.)* Weight, 10 ozs.; Spleen, 28 grs. (Prep. 130.)—Cod. *(M. vulgaris, Europe.)* Weight, 440 ozs.; Spleen, 240 grs. (Prep. 136.)—Halibut. *(Hippoglossus, Europe).* Weight, 592 ozs.; Spleen, 220 grs.—Flounder. *(P. flesus, Europe).* Weight, 7 ozs.; Spleen, $4\frac{1}{2}$ grs.—Eel. *(A. vulgaris, Europe).* Weight, 16 ozs.; Spleen, $4\frac{1}{2}$ grs.

The Spleens of the above-mentioned animals are represented in Plate 2. The *relative* weights of the viscera are given under the various classes.

The subjoined Table gives the relative weight of the Spleen *in the different classes of vertebrate Animals, as compared with that of the Body.**

[For further information I refer the reader to the larger Tables.]

Name.	Weight.	Weight of Spleen.	Relative Weight.
Man	140 lbs.	6 ozs.	About 1— 373
Ourang-Outan	19½ lbs.	About 1 oz.	„ 1— 320
Bat	132 grs.	½ gr.	„ 1— 300
Hedgehog	16 ozs.	23 grs.	„ 1— 306
Lioness	268 lbs.	About 7 ozs.	„ 1— 612
Seal ... ... about	318 lbs.	17 ozs.	„ 1— 299
Kangaroo	37 lbs.	2 ozs. 60 grs.	„ 1— 320
Hare—average of 6 ...	—	—	„ 1—1642
Rat—average of 10 ...	—	—	„ 1— 229
Loris Nycticebus abt.	16 ozs.	About 60 grs.	
Zebra ... ... about	10 cwt.	21 ozs.	„ 1— 779
Dray-Horse about	18 cwt.	—	„ 1— 460
Tapir ... ... about	3 cwt.	1 lb. 13 ozs.	„ 1— 184
Peccary	12 lbs.	340 grs.	„ 1— 248
Giraffe... ... about	16 cwt.	28 ozs.	„ 1—1024
Brockett	40 lbs.	1 oz. 350 grs.	„ 1— 356
Condor...	13 lbs.	45 grs.	„ 1—2034
Sparrow	410 grs.	¾ gr.	„ 1— 546
Parrot	10 ozs. 105 grs.	2½ grs.	„ 1—1126
Cock (old)	5 lbs. 4 ozs.	170 grs.	„ 1— 217
Heron	3½ lbs.	12 grs.	„ 1—2053
Pelican	11 lbs.	39 grs.	„ 1—1980
Boa Constrictor... ...	30 lbs.	280 grs.	„ 1— 762
Chameleon	680 grs.	About ¼ gr.	„ 1—2720
Salmon	126 ozs.	100 grs.	„ 1— 560
Gurnard	10 ozs. 28 grs.	—	„ 1— 150
Halibut	592 ozs.	220 grs.	„ 1—1180
Flounder	7 ozs.	4½ grs.	„ 1— 500
Grey Mullet	10 ozs.	About 30 grs.	„ 1— 141
Cod	440 ozs.	240 grs.	„ 1— 809
Eel	16 ozs.	4½ grs.	„ 1—1540

* In the above Table some of the numbers are not quite accurate, allowances being occasionally made for portions of fat attached to the Spleen, the organ having been preserved in spirits, &c.; on this account the word *about* was generally used. In the original Table the relative weight of the Pelican's Spleen was 1121 instead of 1980. The weight of the Tapir was supposed to be 4 cwt., instead of 3 cwt.; and in the relative weight of the Halibut, the copyist omitted the 0, making the figures 118, instead of 1180. These errors do not affect the general conclusions, but I have thought it right to mention them. It

I must again remind the reader, that although I have selected the most healthy animals, that they were not all living in a state of nature, and for the deductions to be accurate, a vast number of specimens must be examined; but I have reason to believe that domestication and confinement do not materially affect the size of the Spleen, when it remains free from structural change. The Spleens of the Horse, Hare, and Rat, are those only of which I have examined a great number, and about the average weight of which there can be but little doubt.

I can scarcely conceive that any of my readers will consider the above deductions (never before made) irrelevant to the subject of my Essay; if such a notion should cross his mind, let me at once draw his attention to the mist of ignorance and error that these Tables will serve to dispel. In "Blumenbach's Physiology" (p. 197) it is stated that "the Spleen gradually diminishes in size from mammals to fishes." Munro, in his "Comparative Anatomy," (p. 300) makes the same assertion. Wagner, "Elements of Comparative Anatomy," says, "The Spleen of fishes is mostly of small size." But if the above evidence which I have given is to be depended upon, the weight of the Spleen of many fishes, as compared with that of the body, is greater than in any other class of animals. (I speak now of those I have dissected.) In some—the Lamprey, Lampern, and Mixine, for example—I have not been able to discover a Spleen.

Again, most writers on the Anatomy of Birds (Professor Owen, *e. g.* in the "Cyclopædia of Anatomy and Physiology") state that the Spleen is small, and the pancreas large; but in many birds the difference of weight is very slight, and in some it is even larger than the pancreas. I have now before me two Pheasants, a Coot, a Fieldfare, two Starlings, a Sparrow, a Yellow Bunting, and two King-fishers. There is only a difference of one grain between the Spleens and pancreas of the Pheasant (8, 9.) Coot one grain (19, 20.) Starling three grains (5, 2.) Sparrow and Bunting about the same weight; in King-fisher the pancreas is double the size of the Spleen. The length of the pancreas in birds

is, however, of little benefit to look to the relative weight of the Spleen *alone*; it is only in connexion with the weight of the body, and of the other viscera, that useful deductions can be drawn; these will be found in the various divisions of animals hereafter described.

and its two lobes may have led to the assumption that one is small and the other (comparatively) large.

The temperature of the bodies of various Animals, and mode of respiration, are matters of some interest as regards this enquiry, and the following Table by Prevost and Dumas, from "Wagner's Physiology" will not I think be out of place.

Name.	Temperature.	Pulse.	Respiration.	Name.	Temperature.	Pulse.	Respiration.
Pigeon . . .	107-6	136	34	Cat	101-3	100	24
Fowl	106-7	140	30	Goat.	102-5	84	24
Duck	108-5	170	21	Hare.	100-4	120	36
Raven. . . .	107-5	110	21	Horse	98-2	56	16
Lark	117-2	200	22	Man.	98-6	72	18
Simia	95-9	90	30		LIEBIG		
Guinea Pig.	100-4	146	36	Man	97-70	65	17
Dog	99-3	90	28	Woman . . .	98- 2	60	15

Blood mean temperature, 99-50. Temperature of Birds has been found 109. —"*Wagner.*"

Temperature of Black Squirrel, 106; Monkey, 104; Sheep—venous blood, 106; arterial, 107.—*Dr. Davy's* "*Researches, Anatomical and Physiological,* 1839."

The food of animals and the size of the stomach is another matter that should not be lost sight of in the course of this investigation. The large stomachs and long intestinal canal of the *ruminantia* and of some of the *marsupiata*;—the enormous colon and cœcum of some of the *pachydermata*;—the capacious gullets of the serpents, and of some birds and fishes, are also subjects not unworthy of notice; but that which more especially bears upon our inquiry, is the quantity of food consumed by different animals in a given time—some requiring a constant supply, whilst the abstinence of others almost verifies the vulgar notion, "that they live on air." The Boa-constrictor (p. 116), had not fed for ten months, and yet appeared to be in tolerable health. The Chameleon (preparation 126), which I kept alive for several months, only took one meal-worm during ten weeks. Some of the *carnaria* will go a long time without food, whilst the vegetable feeders require a more regular supply. I have known a ferret and a falcon go about fourteen days without eating; and a toad that I kept, would gulp down ten or twelve gentles or beetles in suc-

cession; and yet, an animal of this species has been enclosed in plaster of Paris for twelve months, and scarcely any diminution has been perceived in its weight.

The *quantity* of food, too, taken in twenty-four hours by various animals, is a question of some importance. A sheep, in winter, will consume 25 lbs. of turnips; a horse, from 20 to 25 lbs. of hay and oats; an ox, from 60 to 100 lbs.; and a pig, 10 or 15 lbs. of food daily. According to Boursingault, a horse consumes $97\frac{1}{8}$ oz. of carbon; a milch cow, $69\frac{1}{4}$ oz.

The Dormouse (Prep. 69), in November (weather mild), weighing 400 grs., and *very fat*, ate in three days,—1st day, 360 grs. of apple; 2nd day, 700 grs. of ripe pear; 3rd day, 20 grs. of nuts. The long-eared Owl (Prep. 106) would eat 4 ozs. of flesh at one meal. Birds, with capacious stomachs and gullets, will eat an enormous quantity of food: the gulls, corvorants, and pelicans are good examples of this. The fish, in the stomach of the pelican (*Palmipides*, Prep. 85), weighed 9 oz. The stomach of the Giraffe (weighed in my presence) was 166 lbs., and this organ, in the kangaroo, is often of immense size. Some of the fish are enormous eaters, and their digestion extremely rapid. In the big stomach of the *Lophius piscatorius*, the quantity of fish sometimes found is almost incredible; and in these animals, as in the gulls and corvorants, as well as in the serpents, a part of it remains in the œsophagus. A boa constrictor will swallow an animal of greater weight than itself. The hybernating animal will live upon its fat (without food) for some time; but a spleenless caterpillar will consume, in the twenty-four hours, three or four times its weight of leaves; and the voracity of other insects is remarkable.

I have alluded to these facts for the purpose of showing that the capacity for food has little to do with the presence or size of the Spleen.

The size of the blood corpuscles is likewise a feature in the enquiry that should not escape notice. Thus, the size of the blood corpuscles of the Siren (Plate 85) are comparatively of enormous size, although the Spleen of this animal is very small; and the Lamprey, Mixine, Lampern, and some others that have no Spleen (not perceptible) have the blood corpuscles larger than those of man. The size of the blood corpuscles of the Bat, and the

Giraffe, (see Plate 1, *Ruminantia*), do not differ materially in diameter.*

An interesting question presents itself respecting the blood corpuscles. If these globules in the frog, and other animals with large corpuscles, are formed or destroyed in the Spleen, what must be the size of the capillary vessels of this organ? I might ask whether many of the experiments performed upon this unfortunate reptile (the frog) in consequence of the peculiarities of its structure, have not led to very erroneous inferences?

The development of the brain and nervous system has little to do with the enquiry, but it may be well to remember that the size of the Spleen bears no proportion to that of the cerebral development. Thus the brain of the Lioness that I weighed was only 8 ozs., the Spleen 7 ozs., but in some of the birds which have a larger brain than man, the Spleen is very small.

Other matters besides those alluded to will present themselves to the reader as connected with this enquiry, such as the mode of respiration, circulation, element, climate, muscular power, swiftness, and longevity of the animal. Some of these questions will be spoken of hereafter.

* I had likewise added the Wren, but the long diameter of the blood-corpuscle of this bird is greater than the diameter of the corpuscles of the Bat and of the Giraffe.—*After note.*

ON THE STRUCTURE AND ANATOMY OF THE SPLEEN.

There is no organ in the body, excepting, perhaps, the placenta, that bears any resemblance to the Spleen; no organ differs so much in size, in weight, in shape, colour, smell, consistence, and situation; and, although so much discrepancy of opinion exists respecting its office, it is, I believe, *the only one of the abdominal viscera, that on a superficial examination, reveals a part of its function.* The office of the liver, the kidney, and pancreas, if these parts were examined alone, could never even be guessed at; but the peculiar elasticity of this organ (the Spleen), the absence of an excretory duct; the size of its blood-vessels, and the beautiful arrangement of the valves of the splenic vein in some animals, might I think, lead to the inference, if the inspection were only superficial, that one of the uses of this body is that of a reservoir, or receptacle for the blood; but my business is now to describe the anatomy of the organ in man and the lower animals.

Although the title of this treatise is "The Structure and Use of the Spleen," it must be evident that, in order properly to elucidate its physiology, that its anatomical bearings must be glanced at; but as these are found in all books on anatomy, and as I have nothing particular to add, it would be useless to tire the reader with these repetitions. My object must be rather to touch upon some matters that are "original," and that have not been noticed by former writers, and through this description, my object will be to refer the reader to my preparations and drawings now before him, so that his time may be saved, and he may judge for himself.

The Spleen of man, seated in the left-hypochondriac region, is of a rounded, flattened form, its convex surface being external, and its somewhat concave face towards the stomach. It is attached to the lumbar portion of the diaphragm above, to the renal capsule below, and to the stomach and pancreas on the inner side, by folds of peritoneum. Its upper part is the larger; its anterior edge is sharper than the posterior, and it is provided with a sulcus on its inner surface, into which the vessels and nerves enter. Its connexion with the diaphragm, stomach, colon, pancreas, and supra-renal capsule, are points of practical interest.

By most writers, the Spleen is said to be developed in the centre of the abdomen; but I have not been fortunate enough to get a fœtus (perfect) at the period when it is first visible; but judging from the examinations of twelve fœtuses, some of them at an early period, besides those in Preps. 1, 2, and 8, I am inclined to think that this statement requires further proof. In the lower animals it is first found in its usual situation; and in those I have examined, a few red patches are first seen, in a soft gelatinous material (*blastema*), these gradually coalesce, and after a short time, distinct vessels are seen. In the seven plates, under the head of "Young Animals," the reader will see several drawings of the appearance of the Spleen at an early period in mammals and birds. The Spleen of the Sparrow, (plate 5, E), is a good example of the appearance of the organ in birds at the time of hatching.

In the fœtal lamb, about an inch long, the Spleen is in the same situation as in the adult animal. When first visible, a few vessels only are seen, and those isolated and indistinct, but as gestation progresses the red points coalesce, and the appearance presented in plate 1, figure 8 E, is observed; the Spleen becoming one mass of vessels.

As regards the comparative size of the viscera at the period of utero-gestation in the Sheep, the Liver, Heart, and Kidneys are large, whilst the Spleen and Lungs are comparatively small, the renal capsules about the size of the thymus gland.

At the full period of utero-gestation (I speak from the examination of several children, one now before me), the Spleen, covered by the extremity of the left lobe of the liver, is in contact with the diaphram above, and the colon and supra-renal capsule below The diaphragmatic, gastric, and colic folds of the peritoneum are proportionally shorter than in the adult.

The child I am now dissecting, was born dead at about the eighth month, from protracted labour. It may be taken as a fair specimen of a healthy infant, the following are the weights of the various organs, which are not inserted in the Table.

Body, 6 lbs., (42,240 grs.)—Spleen, 72 grs., $\frac{1}{586}$.—Liver, 3 ozs. 310 grs. (1,630 grs.,) $\frac{1}{25}$.—Pancreas, 56 grs., $\frac{1}{754}$.—Kidney and supra-renal Capsule 196 grs., $\frac{1}{215}$—Lungs, 1 oz., 180 grs., (the child had not respired), 620 grs., $\frac{1}{68}$—Heart, 247 grs., $\frac{1}{171}$.—

Thymus Gland—Thyroid—supra-renal Capsule, 76 grs.—Brain, 9 ozs., (3,960 grs.), $\frac{1}{10}$.

(Prep. 4.) exhibits the Spleen, pancreas, thyroid, thymus, and supra-renal capsule of a Child, at the 8th month of utero-gestation.*

Size and shape.—The Spleen in Man differs in shape more than in any of the lower animals. In the drawings of the 60 Human Spleens that accompany this Essay (*Bimana,)* I find 51 of them are notched and divided in various ways, the notches varying from one to seven. The Spleen (Prep. 142) has seven notches, besides a supplementary Spleen. Nine of the sixty-one Spleens are not divided. One, (plate 11) has two deep fissures in its centre, and these are united by bands of cellular tissue, giving it the appearance of having been sewn. Among the above are two supplementary Spleens. I have found these also twice in Monkeys, once in the Agouti, and once in an Angola Vulture. The subjoined drawing represents two supplementary Spleens in a Monkey, and the branches of the arteries supplying them are well seen in Prep. 38. See likewise four supplementary Spleens of Men. (Preps. 139 and 140.)

The Spleen differs so much in shape in the various classes of animals, that I think I could generally tell to which order an animal belongs, if I saw its Spleen only. That of the Monkey bears the greatest resemblance to Man, as the preparations of the

¶ * I have recently had an opportunity of examining another fœtus, which I removed from the uterus, near the full period of gestation (probably about eight months and a-half.) The body weighed about 7½ lbs.; the thoracic and abdominal viscera, including the contents of the alimentary canal, 14½ ozs. Weight of the viscera in grains, S. 77; P. 58; L. about 1,980; K. 176, (without s. r. c.); H. 320; Lgs. 796.

The blood of this fœtus I examined with great care, within a short time of the mother's death. The blood of the splenic vein was like that of the umbilical cord; the globules about one-fifth larger than those of the mother, and their cell-wall thinner, as shown by their greater alteration of shape when flowing, and their less-rounded form when at rest; three white corpuscles only were seen under the field of the Microscope, this being about the average number of several examinations. The blood of the pulmonary vein presented the same appearance, as did that of the vena portæ, but in the last-named vessels the small nuclei were I think more abundant; these were also present in the aortic blood.

Spleens of thirteen different species of Monkey shew. The preparations 20 and 31, of young Monkeys, bear a remarkable resemblance to that of the child; and the Spleen of the Ourang-Outan (Prep. 17) is more like that of a man than any other animal. In the *Cheiroptera** the Spleen is oblong, with rounded ends resembling the Rat's; in the *Carnaria* and a few of the *Ruminantia,* it is oblong; the ends in the former being more circular than in the vegetable feeders. In the Kangaroo it is forked, (tri-lobed,) and in Dasyures and Phalangers, its shape approaches somewhat that of the Kangaroo; except, however, that one lobe is much shorter than the other two. In the Rodents, the form is generally oblong, with rounded ends; but in the Porcupine it approaches nearer the form of a square, like that of the Lemurs. In some of the *Pachydermata,* the *(Solipeda,)* it is of a somewhat triangular shape, one end near the diaphragm being wide and straight, whilst the free extremity is pointed. In the Tapir, Pig, and Peccary there is the same character, but the extremities are not so dissimilar in size. The Ruminants have nearly all a fan-like or shell-shaped Spleen. In Birds, it is round, oblong, or cylindrical. In Reptiles, oblong, rounded, or somewhat triangular. But in the Fish the greatest variety of form is exhibited. In the Skate and Angler it is of a purse-like form, whilst in many genera, it is long, broad in the centre, with thin edges and pointed ends. In the Shark, the Spleen is lobated, like the kidney of the Bear.

Solidity and Consistence.—The Spleens of the Monkeys, in this respect as in every other, resemble more those of Man. The *Marsupiata,* especially the Kangaroos, have lax Spleens; and those of the *Pachydermata* are so lax and tough, that the Spleen of a Pig may readily be tied into three knots. The Reptiles, many of them, the Boas especially, have solid, flesh-like Spleens, but those of Fish are friable and soft, except in the cartilaginous, where the consistence approaches nearer to that of a quadruped.

The weight of the Human Spleen has been estimated by different writers, from 5 to 12 ozs., but the calculation of Dr.

* At this time the only recent specimens I had dissected, were carnivorous Bats; but judging from one specimen of a large frugivorus Bat (*P. Javanicus*) which I have since examined, (plate 2, fig 30,) the Spleens of the latter are of a rounded form.

Boyd, (Hewson's Works, by Gulliver, p. 265,) appears to me to be the most correct.

Dr. Boyd finds that, in adults, the Spleen is more variable in size and weight than any of the human organs, excepting the womb and ovaries. I am indebted to him for the following notes of his observations.. The bodies died of various diseases.

"In 346 Males, aged from 20 to 60, inclusive, the average weight of the Spleen was 6-78 grs.; the largest Spleen was 35-5 ozs.; the smallest $\frac{1}{75}$ of an ounce. The Spleen was largest between the ages of 30 and 50, when its average weight in 182 males, was 7-23 ounces."

"In 314 Females, aged from 20 to 60 inclusive, the average weight of the Spleen was 5-42 ozs. The largest Spleen was 20 ozs.; the smallest $\frac{1}{25}$th of an ounce. The Spleen was largest between the ages of 20 and 40, when its average weight in 123 females, was 6-47 ozs."

In my own Tables, the average weight would, I think, be about 6 ozs.; but when it is considered that one human Spleen out of four or five, is not in a normal state; and that as hypertrophy of the organ is much more frequent than atrophy, this estimate probably is too high. For the relative proportions as to the weight of various organs in infancy, childhood, and manhood, I refer the reader to the Tables.

Colour of the Spleen.—The natural colour of the human Spleen is of a bluish red, but no organ differs so much in colour as this; and there is a curious fact connected with change of colour, that I am unable to comprehend, viz.: that some Spleens become of an intense red colour (scarlet), whilst others are but little affected by exposure to the atmosphere; this is especially evident in some of the lower animals, as well as in man; but I have observed this change more in those that feed on flesh. The sketch represents the Spleen of a child, aged $4\frac{1}{2}$ years. No. 1. when first taken from the body. No. 2, after a few hours exposure to the air. The former of a dark lake colour, the latter of a bright scarlet.

In *two* others—one Spleen was of a deep red, the other retained its natural hue. Possibly the mode of death, and the nature of the disease, may have had something to do with the colour.

In the Monkey, the colour of the Spleen resembles that of

Man; in the *Carnaria* and *Rodentia* it is of a light red. In the Ruminants the red or purple is interspersed with white spots, which arise from the attachment of the trabecular tissue. In the Rodents, (the Rat and Hare, especially,) the colour is a dark red or lake. In the Marsupials, and some of the Pachyderms, it is of a bluish tint, whilst in the Seals it is of a brownish red, (Prep. 40.)

In Birds; the *Grallæ* and *Passeres* particularly, the surface is often mottled; the substance of the Spleen being seen through the capsule, this appearance being probably given by the trabecular net-work. The shades of colour are very various in the bird; and in the Swallow and Martin,* (June), the Spleen is yellow, (Plate 1, *Passerinæ*), the only animals in which I have observed it of this colour. In some reptiles, as in the frog, toad, and chameleon, it is of a dark red; and in some, black pigment spots are seen; these also are present in the Eel, (Microscopic Prep. No. 45). The Spleens of the Boas are generally of a lighter hue. In Fish, the colour is often a deep lake, forming a curious contrast to the liver, which, in many species, is of a yellowish white; in the Skate and other cartilaginous fish, the colour is a bluish red. It is scarcely necessary to observe that the colour of the Spleen is influenced by the mode of death and the decomposition of the body; and that in many animals, especially in hot weather, it soon becomes dark and pulpy.

I have tried various medicines for the purpose of endeavouring to change the colour of the Spleen, but with the exception of Chloroform (which renders the colour darker), I know of nothing that affects it.

Elasticity.—No organ in the body possesses the same amount of elasticity as the Spleen, excepting of course the arteries and those parts supplied with yellow tissue. After inflation with air or water it soon returns to its former proportions.

The Spleen of an Ox, now before me, measuring 1 ft. 10 ins. in length, can be extended to 2 ft. 7 ins., and will return to its former length; its lateral extent is 6 ins., but it can be stretched

* I have since examined some of these birds at a later period of the year, and found the Spleen of its natural colour.

to 10 ins. and afterwards resume its former size. The end of the Spleen of a dray-horse, 7 ins. long, can be extended to 10 ins.

Capacity of the Spleen.—I find that the Spleen of the Spring-bok, *(A. euchore)*, holds 3 ozs. of water, injected by the vein; when distended and held to the light, the attachment of the trabecular substance to the capsule, producing the white lines externally, is very distinctly seen.

Sheep, (No. 1). Weighing 68 lbs.; Spleen, 3 ozs. 180 grs. Two ounces of warm water, injected by the artery, 6 dms. returned through the vein; squeezing the Spleen, assisting the flow of water from the vein.

Sheep, (No. 2,) 68 lbs.; weight of Spleen, 2 ozs. 380 grs. This Spleen held 4 ozs. of warm water injected through the vein; none flowed through the artery.

(No. 3.) Into the Spleen of a Dray Horse, weighing 4 lbs. 5 ozs., (the Horse about 18 cwt.) six pints of warm water were injected by the vein. (Prep. 72.)

The Spleen of an Ox, weighing 1 lb. 10 ozs., and measuring 12 ins. in circumference, on being distended with air, (by a blow-pipe by the mouth,) measured 21 ins., and contained about 5 pints of air. When held to a strong light, the attachment of the trabecular substance was very distinct, and the divisions in the Spleen formed by it were well seen; scarcely any effect was produced upon the size by the distension of the artery with air.

Into a human Spleen, weighing 7 ozs. 320 grs., I injected 6½ ozs. of water into the vein, although the Spleen had not been long removed from the body, and it contained a large quantity of blood.

STRUCTURE OF THE HUMAN SPLEEN.

The Spleen is surrounded by a peritoneal covering, except where the vessels enter and make their exit; this membrane being a part of the peritoneum, partakes somewhat of the character of the serous membranes generally, and the above remarks will apply to the external covering of all animals that possess a Spleen. It would be useless to give a microscopical description of this membrane, as its microscopical appearances differ in no way from serous membranes generally.

Besides the serous covering, which like all serous membranes,

possesses a great amount of elasticity, the Spleen is surrounded by a fibro-elastic membrane, which is continued into the Spleen to a certain distance upon the coats of the larger vessels, forming a kind of sheath or covering to them. Connected with the capsule, are numerous bands, composed chiefly of elastic tissue; they are better marked, and more easily traced in the ruminants, where drawings and a more minute description of them will be given. These trabeculæ are present in all animals that I have examined, and they are so placed as to include the Malpighian bodies in their meshes; and I believe that they serve by their elasticity, and their attachment to the coats of the vessels, to favor the flow of blood through the Spleen, and probably by the same means, they exercise another important part in the function of the Spleen, *by pressing upon the Malpighian bodies, and thus favoring the passage of their contents into the Spleen-pulp.* In the human Spleen they are well-marked, and the description I have given under the head of *Ruminantia* will apply equally to the human subject, except that they are not so large and numerous as in the ruminants. The experiments respecting their amount of elasticity are well worthy of notice, and go far, I think, to prove their non-muscularity. In Plates 4, 8, 9, 28 E., *(Bimana,)* they are well seen in the human Spleen; and Preps. 9, 10, 11, shew them well in the sheep and antelope. In Preps. 16 and 72, they are beautifully marked in the horse. Prep. 16, is formed by inflating the Spleen of a horse with air, and then gradually drying it. The trabecular net-work presents an appearance not unlike a honey-comb; the cells for the most part large, and of a pentagonal or hexagonal form. In the large Spleen of the dray-horse, which weighed 4½ lbs., from which all the Spleen-pulp has been removed by immersion in water, it will be seen what an important part the trabeculæ occupy in this organ. As a general rule, the size and strength of the trabeculæ correspond with the thickness of the capsule. In man and most of the *mammalia* they are abundant; in birds and reptiles they are less developed; and in fish, where the capsule is generally thin and delicate, the trabeculæ are indistinct as regards their arrangement.

The question of most interest concerning them, and the same remark applies to the capsule, is as to their muscular structure?

I have not been able to detect muscular fibres in the trabeculæ, nor in the capsule of the Spleen, which is of the same structure with a less amount of yellow tissue. The following experiments go far, I think, to militate against their muscularity.

In the presence of my friend, Mr. Adkins, I extirpated the Spleen of a dog under the influence of chloroform, by dividing the abdominal parietes, and then applying the points of two wires, connected with a weak galvanic battery, to the Spleen, not the slightest muscular contraction could be seen.

The same experiment was tried upon another dog with the same result.

Two rats also were experimented upon in the same manner, with a similar result. The galvanic wires applied to the *intestines* produced instant contraction.

These experiments appeared to me to be so conclusive, that I did not repeat them upon the horse, as I originally intended.

The Malpighian bodies are small, round, whitish looking corpuscles, situated between the trabeculæ, and having a very slight attachment to them by means of delicate fibres: but this attachment is so slight, that they are easily removed, and their delicate capsule may be seen entire; sometimes with vessels ramifying upon it. I have never seen these *distinctly* in any injected preparation: but in the hypertrophied Spleen of a horse, (Plate 6, Pathology E.) I could clearly distinguish them under a power of 60 diam., and trace the vessels into them, and also see them ramifying on the surface of the corpuscle.

The size of these bodies varies much in different animals, and in the same animal at different times; although they are generally uniform as to size in the human Spleen. They are very distinct in the young subject, and generally so in the adult, when the Spleen is fresh. In children I have seen them so prominent, that on tearing the Spleen, they looked like a bunch of currants thickly set together. The drawing (Plate 8, *Bimana*, E., Plate 1, fig. 17), I took at the time of the rupture, and the corpuscles were pulled out with the artery, and they are now beautifully seen in Prep. 8, (SMALL bunch), where also a portion of the Spleen of another child at birth, shows the arterial tufts of the corpuscles unravelled. But I have only seen these corpuscles assume the same appearance

in the human Spleen, (as in Plate 25, fig. 3 E,) when, as the drawing shews, they had a pearly whiteness, forming a remarkable contrast to the red colour of the Spleen, and looking like the corpuscles in Prep. 8 *a*, from the fried Spleen of a sheep. The history of the case is given in the Pathology of the Spleen. (Plate 1, fig. 36.)

The Malpighian corpuscles are larger in the ruminants than in any other animal. Prep. 10, shews them in the ox and sheep, although their rounded form is altered by spirit. In the preparation, their partial attachment to the trabeculæ may be seen; in the ox, sheep, horse, and pig, the Spleen corpsucles are very large ; in the first animal they are sometimes nearly a line in diameter. In several monkeys I have seen them very prominent, and in a young ape, they presented nearly the same appearance as in the child (Prep. 8). In most of the *Carnaria*, the lion, tiger, leopard, bear, they are well marked, but in the common cat I have seen them more beautifully developed than in any animal. In plate 20, fig. 2, *(Carnaria,)* these corpsucles are very distinct in the Spleen of a cat after immersion in water for fourteen days; but the subjoined sketch shews them at a more recent period; they are magnified about 40 deg. (*Vide* Plate 3, fig. 4.)

In the *Rodents*, especially in the Beaver, they are very conspicuous, but as we descend in the animal scale they are less prominent. The fresh Spleens of Birds exhibit them generally, but they are better seen in the *Gallinæ* than in any other class. I have not seen them in the reptiles, but these (the larger ones), have seldom been examined in their natural state. In the soft Spleens of most bony fishes they are not visible ; but in the Skate, and other cartilaginous fish they are readily seen. The delicate membrane covering these corpuscles is very apparent in some of the ruminants, and when it is ruptured the corpuscle loses its rounded form. As regards the number of these corpuscles ; in a slice of fried Spleen of a Sheep, 2 ins. long, by 1 in. wide, where they became white and albuminous, (Prep. 141) I have counted about 300. .

Spleen-pulp.—The Spleen-pulp is a reddish-brown, thickish fluid, occupying the space not occupied by vessels, nerves, and elastic tissue, between the Malpighian bodies. It is composed of granules, nuclei, and nucleated cells, but the presence of the last,

I believe, is the exception, not the rule. With a bad instrument, most of these corpuscles appear to be granular, but this appearance is very deceptive; for the same bodies, when seen with a good instrument, and when properly focused, entirely lose their nucleated appearance. Another mode of deception, I believe, is the presence of granules upon the outer surface of the cell-wall, and not *within* it.

One of the greatest characteristics, perhaps, of the cells of the Spleen-pulp, is their irregular form, owing, probably, to the thinness of their walls; when flowing, they assume a somewhat fusiform appearance, but when at rest, their shape is more circular. In well-fed animals especially, many of them are of a reddish colour; but I have never seen the large cells containing blood corpuscles described by Kölliker, although the aggregation of blood corpuscles, with a kind of albuminous cyst, is not unfrequent. How such cells as those mentioned by Kölliker, could traverse the capillary vessels, or find their way into the Spleen-pulp, it is difficult, I think, to conceive?

The contents of the Malpighian bodies differ but little from those of the Spleen-pulp, and like them, they vary in appearance at different times in the same class of animals; sometimes presenting a white, round, granular appearance, with red corpuscles, of irregular shape, dispersed among them, and a vast number of granules.

On examining the Spleen-pulp, and the contents of the Malpighian bodies, one is struck with the resemblance between their cells and the blood corpuscles,—*they appear like blood corpuscles in a state of imperfect development.* They differ, too, much in size and form; and I have never found them in the blood of the splenic vein. I have, on most occasions, examined the spleen-pulp of the animals I have dissected, and in many of the drawings, I have given a representation of it; but it is to plate 1 E, first in large folio, that I wish to draw the reader's attention, because these drawings are taken from the Spleen-pulp of different animals. (*Vide* plate 3, of this Treatise.)

I recently examined the spleen-pulp of a hare, pheasant, hawk, starling, sparrow, field-fare, water-rat, and king-fisher, but, in none of them could I discover a nucleated cell, although many of them were faintly granular. This opinion was confirmed by my

friend, Mr. Adkins. On other occasions, however, nucleated cells, especially in the ruminants, appeared to be present.

Relative Weights of the Contents of the Spleen.—As regards the relative proportions of the various parts of the Spleen, it is difficult to give a correct estimate, as the quantity of spleen-pulp and the size of the Malpighian bodies differ much, as I have before remarked, in various animals, as well as in the same animal at different times. The calculation respecting the relative weights of the elastic tissue of the Spleen and its fluid, or semi-fluid contents, is one, however, attended with less difficulty when a healthy Spleen is the subject of the experiment.

The hypertrophied Spleen presents a remarkable contrast to one in a normal state. The former is solid, heavy, firm, and inelastic; the trabecular tissue is less distinct, and from gradual stretching, appears to lose a portion of its elasticity, and the grumous spleen substance is often replaced by fibrinous deposit.

The results of the following experiments are very conclusive:—The hypertrophied Spleen of a child, aged two years, was put into water with the Spleen of a strong, healthy man, who died instantly, and the cause of death was not apparent on a careful inspection. On the 5th of July (five days after immersion), a section was made of the Spleens, and they were pressed with the hand under water for some time, and a stream of water allowed to fall upon them. A small quantity of dark grumous bloody fluid escaped from the veins of the child's Spleen, and its weight, originally 8 ozs., minus 60 grs., was reduced to 6 ozs. 280 grs. The spleen-pulp flowed in great abundance from all parts. The man's Spleen, which contained air, and crackled on pressure,—the weight, originally, 6½ ozs., was reduced to 2 ozs. 120 grs.; and after a further immersion of five days and occasional exposure to the stream of water, it weighed only 345 grs. The vessels, nerves, capsule, and trabecular tissue, only remaining.

The Spleen of a man, æt. 75, was immersed in water for five days, and after all the blood and spleen substance had been removed by pressure and exposure to a stream of water, the weight was 660 grs.

The Spleen of a woman, æt. 55, which weighed 3½ ozs., after being subjected to the same process, weighed only 180. grs.

The Spleen of an antelope, weighing 2 ozs. 100 grs., was kept in water for several days, and exposed to a stream of water; it then weighed only 120 grs.

The Spleen of the dray-horse, weighing 4½ lbs. (Prep. 72), after immersion in water for three weeks, and after the Spleen-pulp was pressed out, weighed only 16 ozs.

Blood Vessels, Nerves, and Absorbents of the Spleen.—It is useless to give the exact course of these vessels, as they are known to every student of Anatomy; but there are many circumstances connected with the form, size, and distribution of the artery and vein, that present points of especial interest.

The splenic artery, is the largest branch of the cœliac axis, but as it supplies a part of the pancreas and the left end of the stomach, the quantity of blood to the Spleen is much diminished. The serpentine course of this artery, too, in man, is a circumstance of great interest in this enquiry; for it is a beautiful provision to accommodate the supply of blood to the demand of the left end of the stomach, where digestion is principally performed. When the stomach is distended, the artery is probably straightened, and the supply of blood to this viscus by that means increased. I have taken the exact size of the splenic artery in four adults, and the subjoined is a sketch of them; the arteries were all injected with wax, but by this means the relative magnitude of the vessels is better seen as they are all exposed to the same degree of pressure. (In one of these, a male, 40 years of age, the diameter of the artery is 2½ lines; that of the vein, 5 lines.)

The length of the artery varies in different animals, according to their size, and according to the size of the stomach. In nearly all the Mammalia, the artery, as in Man, arises from the cœliac axis, but in the horse it is given off singly from the aorta. In Plate 8 E, (Vessels, Nerves, and Absorbents), I have taken by accurate measurement, the aorta and its abdominal vessels of the boa constrictor, guan, greyhound, monkey, civet cat, sheep, peccary, and kangaroo; and in the remaining Plates E, the arteries of the child, monkey, leopard, bear, lion, surikate, otter, harpy eagle, and chicken, are shewn.

The splenic artery of the bird arises from the cœliac axis, as in man; whilst in serpents, the coronary and the splenic arise from

a common trunk, and the hepatic, which supplies the elongated liver, is given off considerably above these. Small pancreatic branches supply the pancreas, which is smaller in serpents than the Spleen. In the Bull Frog (Plate 17, *Reptilia,*) the splenic coronary and hepatic, are seen to arise from one axis; but the splenic and superior mesenteric are a division of the same branch.

In the Human Spleen, the divisions of the arterial branches which enter the organ, vary from five to eight, and in the Monkey they are about the same number. In the *Carnaria*, and in animals with long Spleens, they are more numerous. In some animals, the pig and peccary, for example, instead of the vessels entering a sulcus, the Spleen is elevated into a pointed edge at this part. In birds, the splenic artery is very large, and the spleens of the smallest are injected by this vessel. In fish, the artery is large and yielding; but in some reptiles its coats are thicker.

The difference between the arrangement of arteries of the Pachyderms and the Ruminants will be described under the chapter which treats upon these animals.

The splenic artery differs in structure from no other artery of the body; it consists of five coats; the cellular, *(inelastic)*, the yellow tissue, the sub-serous, the serous, and the epithetial. It is unnecessary to depict these structures, as they are seen in many books on Physiology.

In the splenic artery of the Horse and the Zebra, (once seen), the artery presents a muscular, fleshy appearance, but on immersion in water this appearance is removed. I have not seen the peculiar contraction and relaxation of this artery, spoken of by Hunter and other Physiologists, nor have I been able to discover muscular fibres in the middle coat of this or any other artery; and, as the best microscopists disagree upon this point, let me ask the reader to try a physical test, which to my mind proves more than the microscope.

Take a piece of the supposed muscular artery of the horse, and a portion of the involuntary muscle of the intestines, and test their identity of structure and amount of elasticity by stretching them; the observations of Kölliker upon this, and many other points, are confused and contradictory. The subjoined remarks, from the article alluded to, p. 774, express the doubts of Kölliker respecting

the muscular fibre cells of the trabeculæ. "But, more recently, I have made some observations, which have again thrown me into complete uncertainty in respect of the import of these questionable structures. Thus, I believe myself to have verified, that these fibres occur in the human subject, rolled together in a kind of spherical cell (Fig. 525-2) of $\frac{5}{1000}$ to $\frac{7}{1000}$ths of a line in diameter, and that on tearing up this structure, they become free, and extend themselves. But since this fact in no way harmonises with the nature of muscular fibre-cells, and is, besides, altogether obscure and incomprehensible to me, I hesitate to express, at once, an opinion concerning the above-mentioned structures in the human Spleen, but am desirous of calling the attention of inquirers to this peculiar arrangement, which, on account of its constancy and frequency, is very interesting."

One peculiarity about the arteries of the Spleen is their abrupt termination. In the beautiful Preparation, No. 5, (Plate 1, fig. 19) the injected arteries of the Spleen of a man who had Walcheren fever, and who died in England, this peculiar arrangement of the vessels is remarkably well seen, as all the branches are considerably englarged. The small arteries are seen to pass off from the larger trunks, and to terminate in minute tufts resembling somewhat some of the *cryptogamiæ.* The subjoined drawing, from another injected human Spleen, shows also the termination of the vessels, and the one above it, the capsule and arteries of the *Lophius Piscatorius* (angler fish). Prep. No. 6 *a,* also shows the same arrangement of the terminations of the arteries of this fish.

They are also well seen in the child (Prep. 8 *a*), and in the Spleen of the antelope (Prep. 9). With these Preparations, I am desirous the reader should contrast wet prep. 6 and 7 of the placenta, and microscopic prep. 46, of the same part. As I have said before, I have not been able to trace the extremities of these vessels, but I am inclined to think that they chiefly surround the splenic sacculi; and like the arteries of the glands, supply them with blood for their peculiar secretion (probably.)

I refer the reader to microscopic Preps. 4, 17, 27, 28, 29, 32, and 33, for the arrangement and appearance presented by the injected arteries of different animals.

Splenic Vein.—Kölliker, and all the writers that I have read,

state, "that the splenic vein, and the veins of the portal system, are destitute of valves." This applies to the splenic vein of man; but I suspect, that in many of the lower animals, the valves of the splenic vein, both outside and inside the Spleen, are present. I first discovered this in the giraffe, where they are seen (as in Prep. 12;) but in the horse, an animal whose muscular power and circulation are deranged more than any other by violent exercise, they probably are more numerous than in any other. Preps. 14 and 15 shew them in the horse, and in the latter prep. they are seen likewise in all the lateral veins; they are more minutely described under the head of *Solipeda.* They are also present in the sheep, about three-fourths of an inch before the vein enters the organ. In the tapir, pig, and ox, I have also found them, as well as in the zebra. Unfortunately I did not suspect their presence when I first commenced my dissections, and therefore they may have escaped my notice in many animals.

Although the human Spleen is not supplied as in the quadrupeds alluded to, yet the construction at the mouths of the veins is so beautiful, that there is a complete valvular arrangement, which to a great extent prevents the reflux of the blood; and in the whole animal structure I know of no fact more beautifully apparent than this; and in Plate 6 E (of the Arteries, Veins, and Absorbents) of the leopard, this arrangement is well demonstrated, so that when the vein is distended with blood, the regurgitation into the splenic substance is in some measure prevented by the partial closure of the venous apertures.

The veins accompany the arteries, and their course in the ox is exhibited in the (dry) Prep. 191. In the human Spleen they possess an epithelium, extending to the larger veins. In the smaller branches in man, and in many of the larger, in ruminants, the coat is so delicate as to have given rise to the notion, that the veins terminated in cells within the splenic substance. Their anatomical structure, except the peculiarity just alluded to, does not differ from that of the other veins of the body. The splenic vein of man is three or four times the calibre of the artery when distended; and the experiment mentioned at p. 39, respecting the vein of the dray-horse, is a proof of the enormous capacities of these canals, as compared with the arteries. The comparative

size of the splenic vein and artery is shewn in many of the drawings, and the assertion made by some, that blood does not coagulate in the splenic vein, is disproved by many of the preparations. The many microscopical examinations, too, shew that there is little if any difference in the blood of the vein* and that of the artery.

The nerves of the Spleen are derived from the splenic plexus, and they differ in no respect from those in other parts of the body. They accompany the arteries, and a branch of the nerve much smaller than the main trunk, runs with each branch of the artery; sometimes two branches accompany the artery. I have traced them to the Malpighian corpuscles, but whether they enter these, or are expanded on their outer surface, I am unable to determine. Indeed, it is difficult, if not impossible, to trace the ultimate termination of the nerves in any part of the body.

These peculiarities in the different classes of animals will be alluded to hereafter, and Preps. 10, 11, 13, 15, shew them at the entrance of the spleen of the giraffe, lion, tapir, and horse. In the Plates E, (of Nerves, Arteries, and Absorbents,) they are also seen in the leopard and other animals.

The nerves of the horse are larger than any other animal that I have dissected, and Kölliker must have forgotten this animal when he speaks of their immense (comparative) size in the ruminants, (p. 794.)

The lymphatic glands and vessels are comparatively less in the spleen than in the liver, and in the other abdominal viscera. The glands differ much in size in the human Spleen. I have found them from the size of a pin's head to that of a nut, but their normal size is very small.

In Plates 8, 15, 25, E, they are large, and in Plate 8, the drawing represents the vessels leading from them. I have not succeeded in injecting the lymphatic vessels of the human Spleen, and in the Horse, in one instance only, although I tried a great many Spleens; and the vessels in this animal are very distinct. Prep. 10 shews an absorbent gland that I injected with quick-

* At this time my examinations had been confined chiefly to the blood of the human Spleen.

silver. Occasionally, after many trials, these vessels have been well filled with quicksilver, and they are found to be much more numerous on the outer surface of the organ. In the tapir and horse, the glands are oblong and large; often an inch or more in length. In the monkey, I have found them larger than in man. In some of the Rodents they are larger in proportion than in the human species. In man their termination is in the *lumbar* glands.

SIZE AND WEIGHT OF THE HUMAN SPLEEN IN FŒTAL LIFE, INFANCY, AND CHILDHOOD.

¶ The weights of the viscera of the different classes of animals in the manuscript Essay are placed under separate columns, including generally, country, age, sex, nature of food, condition, cause of death, weight of body, length of alimentary canal, absence of gall-bladder, and reference to plates and preparations.

For the sake of economy and conciseness I shall avoid the tabular form, and place this information under each order, *adding* generally the *relative* weight, or assumed weight, of the organs.

As the abbreviations will apply to *all* the examinations, the reader is requested to observe the following :—S. Spleen; L. Liver; P. Pancreas; K. Kidney; H. Heart; Lgs. Lungs; A. C. Alimentary Canal; B. Body; Nl. Normal; Bt. Breadth; Lt. Length; Ls. Lines: Wt. Weight; Grs. Grains; M. Male; F. Female. When E. is used after allusion to the drawings, it applies to the original Essay. For other explanations I refer the reader to page 10 and to the Preface.

FŒTAL LIFE AND INFANCY.

In plate 1 E., I have the drawings of ten Fœtal Spleens, the fetuses all preserved in spirits. I weighed the bodies, but the age and the weight of the Spleens were guessed at. See Plate 1, figs. 1 to 7 in this Treatise, where seven of these Spleens are represented. The weight of all is in grains.

No. 1. Fœtus; age about two months; B. 250; S. 2.—2. Two months; B. 420; S, 1.—3. B. 880; S. 3.—4. Three months; B. 2,200; S. 5.—5. Four months; B. 3,520; S. 10.—6. Five months; B. 4,400; S. 10.—7. Six months; B. 10,560; S. 24.—8. Six months; B. 880; S. 30.—9. Seven months; B. 24,640; S. 90.—10. Seven months; B. 25,520; S. 90.—The last, No. 10, has a supplementary Spleen about the size of a pea.

The undermentioned I examined in a recent state soon after death, and therefore the deductions are of more value.

No. I. F. B. 1,476; S. *about* 3; L. 60; K. 10; H. 20; Lgs. 30; Brain, 340; (the brain and body weighed;) the weight of the other organs guessed at, as I injected the aorta with size and vermillion.

(Prep. 4.) The Spleen in this fœtus was in the usual situation; loosely attached to the left side of the stomach, by the gastro-splenic omentum, and being in contact with the supra-renal capsule below. The blood consisted of blood corpuscles, lymph corpuscles, and granules. The Thymus-gland, bi-lobed; its weight about 4 grs. The Spleen injected, under a power of 40 diameters, presents on the exterior, innumerable small vessels, and in the interior the larger branches are seen to send off single branches at intervals; these divide, generally, into two or three shorter trunks, which terminate abruptly in tufts of minute vessels; in one portion of the slice examined, these appeared to surround one of the Malpighian bodies. (Mic. Prep. 19, and Plate 1, fig. 16.)

No. II. and III. Twins about the seventh month of utero-gestation.

II. *m.* B. 2 lbs. 7 ozs. (17,160 grs.); S. 18 $\frac{1}{953}$; L. 1,120 grs. $\frac{1}{15}$; K. 74 $\frac{1}{230}$; H. 120 $\frac{1}{143}$; Lgs. 560 $\frac{1}{30}$: Thymus gland, 60 grs. $\frac{1}{286}$; A. C. 13 ft. 3 in.

III. *f.* B. 2 lbs. 4 ozs. (15,840 grs.); S. 19½ $\frac{1}{812}$; L. 615 $\frac{1}{25}$; K. 70 $\frac{1}{226}$; P. 12 $\frac{1}{1320}$; H. 110 $\frac{1}{144}$; Lgs. 360 $\frac{1}{44}$; Thymus gland, 48 $\frac{1}{330}$; A. C. 10 ft. 3 in. A small supplementary Spleen.

IV. *m.* 9th month of utero-gestation; B. 6 lbs. 14 ozs. (48,400 grs.); S. 138 $\frac{1}{305}$; L. 2,420 $\frac{1}{120}$; K. 120 $\frac{1}{403}$; H. 138 $\frac{1}{305}$; Lgs. 760 $\frac{1}{63}$; Thymus gland 90 $\frac{1}{537}$; A. C. 14 ft. 3 in. The meconium in the large intestines weighed 3½ oz.; the contents of the stomach and small intestines 360 grs. This child was found dead. The Spleen and liver were dark coloured; the spleen did not change colour on exposure to the air.

V. *m.* 9th month of utero-gestation; B. 5 lbs. 1 oz. (35,640 grs.); S. 95 $\frac{1}{396}$; L. 3,080 $\frac{1}{11}$; P. 61 $\frac{1}{584}$; K. 183 $\frac{1}{194}$; H. 230 $\frac{1}{154}$; Lgs. 1,760 $\frac{1}{20}$; Thymus gland, 140 $\frac{1}{254}$; A. C., 15 ft. 9 ins. Bile thick, yellow, and albuminous. This child lived only two hours after birth; the cause of its death, doubtful.

VI. *m.* 9th month of utero-gestation; still-born. B. about 6½ lbs.; S. *about* 100 grs. The other organs weighed (Spleen and stomach injected), L. 1,980; P. 30; H. 125; Lgs. 1,540; Thymus gland, 170; Al C. 14 feet 1½ inch.

VII. *m.* 9th month of utero-gestation; still-born; S. 120 grs.—VIII. *f.* 11 days; emaciation and debility from birth; S. 77 grs.,—a small supplementary Spleen.—IX. *m.* 3 months; abscess of lung; S. 360 grs.—X. *m.* 15 months; Bronchitis; S. 378 grs.—XI. *m.* 10 hours, protracted birth; B. 7 lbs. (49,280 grs.), S. 220 grs.—XII. *m.* 8 months; thin *Pleuro-pneumonia*; B. 7 lbs. 2 ozs. (50,160 grs.), S, 234 $\frac{1}{214}$; L. 2,200 $\frac{1}{22}$; H. 370 $\frac{1}{135}$; L. (inflamed), 2,640 $\frac{1}{19}$; A C. 16 ft. 5½ ins.; length of body,

23 ins.—XIII. *f.* 20 months; Bronchitis; S. 460 grs.—XIV. 10 months; Pneumonia and Bronchitis; B. about 14 lbs.; S. 685 grs.—XV. *f.* 10 months; Anæmia; B. about 12 lbs.; S. 1,320 grs.—XVI. *m.* 2 years; Hæmorrhage (see chapter on Pathology), S. 3,460 grs —XVII. *m.* 5 years, B. about 42 lbs.; S. 2,200 grs. This child, I believe, died from suppressed scarlatina; I could not discover any disease in the viscera; the A. C. measured 25 ft. 4 ins.; the B. 3 ft. 4 ins.—XVIII. *m.* 4 years and 9 months; *Pleuro-pneumonia* of right lung; B. (thin) about 24 lbs.; S. 484 grs.; L. 3,520 grs.—XIX. *m.* 2 years (see chapter on Pathology), S. 3,520 grs.; L. 5,280 grs.

¶ In the above 19 children, the Spleen was hypertrophied in 4 (Nos. 16, 17, 18, and 19), and apparently normal in the remainder. Two supplementary Spleens existed (3 and 8). In the 10 fœtal specimens in spirits first described, the Spleens appeared to be normal; and among these, there was one supplementary Spleen, making three instances in the 29 specimens.

THE WEIGHT OF FIFTY HUMAN SPLEENS, (ADULTS,) WITH THE CAUSE OF DEATH, &c.

No. I. *m.* 56. Sanguineous Apoplexy. B. *about* 11 stone (154 lbs.) 1,084,160 grs,; S. 6 ozs. 2,640 grs. $\frac{1}{410}$; L. 4 lbs. 2 ozs. 29,040 grs. $\frac{1}{37}$; P. 3 ozs. 1,320 grs. $\frac{1}{821}$; K. 3ozs. 1,320 grs. $\frac{1}{821}$; H. (enlarged) 20 ozs. 8,800 grs. $\frac{1}{123}$; Lgs. (congested) 5 lbs. 2 ozs. 36,080 grs. $\frac{1}{30}$; Brain 3 lbs. 21,120 grs. $\frac{1}{51}$. The Spleen, which is represented at Plate 9 E, is deeply fissured, the edges of the fissures being united by cross bands of cellular tissue. The patient died in 3½ hours from the time of seizure; had been under my care at the Metropolitan Dispensary for epileptic fits, combined with hypertrophy of the left ventricle of the heart, and with albuminous urine. The heart presented no appearance of fatty degeneration to the naked eye; the left ventricle was much thickened, and the mitral valves converted into a cartilaginous ring. Both kidneys were affected with Bright's disease. There were 8 ozs. (by weight) of fluid blood in the brain, the septum of the ventricles being broken down. The arteries at the base of the brain apparently normal, as were the larger trunks in the chest and abdomen.

II. *m.* 65. Bright's disease of Kidney and Nutmeg Liver. B. about 10 stone; S. (enlarged) 14 ozs. 6,160 grs, $\frac{1}{160}$; L. 3 lbs. 4 ozs. 22,880 grs. $\frac{1}{40}$; P. (enlarged) 6 ozs. 2,640 grs. $\frac{1}{373}$; K. 6 ozs. 2,640 grs. $\frac{1}{373}$; H. 9 ozs 3,910 grs. $\frac{1}{241}$; Lgs. (consolidated) 5 lbs. 8 ozs. 38,720 grs. $\frac{1}{25}$; A. C. 26 ft. 5 ins.; length of body 5 ft. 8 ins.

III. *m.* 23. Meningeal Apoplexy. B. about 11 stone (154 lbs.); 1,084,160 grs.; S. 6 ozs. 2,640 grs. $\frac{1}{410}$; L. 4 lbs. 28,160 grs. $\frac{1}{38}$;

K. 4½ ozs. 1,980 grs. $\frac{1}{547}$; P. about 2 oz.; H. 9 ozs. 3,960 grs. $\frac{1}{273}$; Lgs. 2¾ lbs. 19,360 grs. $\frac{1}{56}$.

IV. *m.* 71. Tubercles in the Lungs. B. about 6½ stone (92 lbs.) 647,680 grs.; S. 3 ozs. 120 grs. 1,320 grs. $\frac{1}{449}$; L. 3 lbs. 4 ozs. 22,880 grs. $\frac{1}{28}$; K. 4 ozs. 1,760 grs. $\frac{1}{368}$; H. 8 ozs. 3,520 grs. $\frac{1}{184}$; Lgs. 2 lbs. 6 ozs. 16,720 grs. $\frac{1}{38}$; A. C. 28 ft. 8 ins.; length of body 5 ft. 7 ins.

V. *f.* 75. Old Age; B. about 8 stone (112 lbs.) 788,480 grs.; S. 4 ozs. 200 grs., 1,960 grs. $\frac{1}{402}$; L. 2 lbs. 6 ozs. 16,720 grs. $\frac{1}{47}$; K. 2 ozs. 880 grs. $\frac{1}{896}$; H. 8 ozs. 3,520 grs. $\frac{1}{224}$; Lgs. 2 lbs. 5 ozs. 16,280 grs. $\frac{1}{48}$; A. C. 36 ft. 2 ins.; length of body 5 ft. 2 ins. The Spleen was dark, soft, and pulpy. (Plate 13, fig. 14 E.)

VI. *m.* 55. *Pleuritis* and *Pericarditis.* B. about 10½ stone, (147 lbs.) 964,480 grs.; S. 2 oz. 350 grs., 1,230 grs. $\frac{1}{784}$; L. 2 lbs. 15 oz. 20,680 grs. $\frac{1}{46}$; H. 24 oz. 10,560 grs. $\frac{1}{91}$; Lgs. 26 ozs. 11,440 grs. $\frac{1}{84}$. The pleuritis was confined to the left side; the left lung, which weighed 14 ozs., was solid from old *pleuro-pneumonia;* about a pint of serum in the left pleura. The pericardium inflamed, and the heart much enlarged; the capsule of the spleen was covered with patches of recent lymph; the Spleen curiously divided at the upper end by two lateral fissures; the yellow coat (elastic) of the splenic artery and its branches thickened. The *trabeculæ* of the spleen very distinct. (Plate 20, E).

In the above six examples the bodies were not weighed, but I believe the estimate is tolerably accurate. The weights in the Essay were not reduced to grains, nor were the relative proportions given; I make this addition for the purpose of saving the reader the trouble of computation. In the subjoined cases, the Spleen only was weighed, and in a few instances the supposed weight of the body noted.

VII. *m.* S. 9 ozs.—VIII. *f.* 33; B. about 6 stone; S. 3½ ozs.; A. C. 23½ ft.; Lt. of B. 5 ft. 2 in. Death rather sudden. The heart, fat and flabby.—IX. *f.* 53. Tuberculous Lgs., and ulcerated Colon; S. 4 ozs. 40 grs.—X. *m.* 50. *Peritonitis*; B. 10 stone; S. 6½ ozs.—XI. *m.* 30. Sudden death, cause unapparent; B. 12 stone; S. 4 ozs.—XII. *m.* 55. Tubercles in the lungs, and fatty liver; B. 8 stone; S. 3½ ozs.—XIII. *m.* 52. Diseased brain and paralysis; B. 10 stone; S. 5 ozs. 70 grs.—XIV. *m.* 75. Diseased brain and paralysis; B. 9 stone; S. 4 ozs. 100 grs. The capsule of the spleen covered with fatty and cretaceous deposit, (Plate 11 E).—XV. *m.* 45. Apoplexy; B. 13 or 14 stone; S. 5 ozs. 440 grs. A small supplementary Spleen was present, and the Spleen was attached by a slip of adventitious membrane to the muscular part of the diaphragm. The splenic artery, at its entrance

into the Spleen, as shewn by the drawing, measures $1\frac{1}{2}$ line; the vein at its exit, 3 lines; when stretched with forceps, the artery, 3 lines; the vein $5\frac{1}{2}$ lines.—XVI. *f.* 68, *Paralysis*; S. 3 oz. 100 grs.; soft and flabby, otherwise normal.—XVII. *m.* cause of death unknown; S. 7 ozs. XVIII. *f.* 39. Chronic *Bronchitis;* S. 3 ozs. 215 grs. The artery at its entrance into the Spleen as shown by the drawing, (Plate 13 E.,) measures $1\frac{3}{4}$ line; the vein $3\frac{1}{2}$ lines; the nerve about $\frac{1}{3}$d of a line. This Spleen has two deep fissures, their sides united by elastic tissue.—XIX. *f.* 40. Cancer of the uterus; S. about $4\frac{1}{2}$ ozs. The Spleen firmly adherent to the diaphragm, and covered with lymph (old); abundance of lymph was also deposited under the capsule, as shown in Plate 14, fig. 16, E.—XX. *f.* 82. Old age; S. about 4 ozs. The capsule of this Spleen covered with cartilaginous, and cretaceous deposit; it was much thickened. (Plate 1 fig. 33.)—XXI. *m.* 43. *Acute Pneumonia;* S. 5 ozs., 230 grs. XXII. *m.* 50. *Ascites*; heart disease; the heart three times its natural size; S. 7 ozs. Five absorbent glands were seen near to the entrance of the splenic artery; the largest of these glands measures: Lt. 3 lines, Rt. $1\frac{1}{2}$ line. (Plate 15, fig. 20 E.)—XXIII. *m.* 65. *Hemiplegia;* S. $4\frac{1}{2}$ ozs.—XXIV. *f.* 26. Lumbar Abscess, and fatty liver; S. 4 ozs. 230 grs.; L. 5 lbs. 6 ozs. (See case in chapter on the Pathology of the Spleen.)—XXV. *f.* 23. Bright's disease of kidney; dropsy; S. 6 ozs., 120 grs. The capsule of the Spleen covered with patches of recent lymph, the liver soft, bile thick, and the gall-bladder contained 11 angular-shaped, black calculi. The patient had been a "hard drinker."—XXVI. *m.* 57. Bright's diease of Kidney and nutmeg Liver; S. about $1\frac{1}{2}$ oz.—XXVII. *m.* 70. Bright's disease of Kidney, and diseased Spine; S. 7 ozs. 200 grs.; dark, soft, and pulpy, with a great deal of fat on the gastro-splenic ligament. A supplementary Spleen $1\frac{1}{2}$ inch long, and 10 lines in width, was present, and 8 absorbent glands about the size of small peas were counted. The Spleen pulp consisted of large, irregular shaped, very transparent, unnucleated cells;—of blood-corpuscles, granules, single and aggregate, and of cells with one large nucleus (Plate 21 E.)—XXVIII. *f.* 46; obstructed bowels; S. 2 oz. 380 grs. This Spleen, which presented a very strange appearance, was deeply fissured transversely, and delicate fibrous bands united the sides of this fissure; the centre, external part of the Spleen was of a light red colour, whilst the edges and inner sides were of a deep blue. The Spleen-pulp, likewise, in the last-named parts, had a deep blue tinge; and the trabeculæ and one arterial twig were of the same hue. The blood of the splenic vein contained a few white corpuscles; the blood of the artery not examined (Plate 21 E.)—XXIX. *m.* 62. Gall-stone;

hard pancreas; S. 2 ozs. 380 grs. (See case in chapter on Pathology). XXX. *m.* 21. Suffocated by carbonic acid gas, S. 2 ozs. 200 grs. The lungs, liver, heart, and Spleen much congested; but the Spleen exhibited no evidence of congestion. White corpuscles of the blood abundant (Plate 20, fig. 31).—XXXI. *m.* 32. *Pneumonia;* S. 11 ozs. 400 grs. XXXII. *m.* 21. *Bronchitis;* S. 7 ozs. 320 grs.—XXXIII. *m.* 22. *Pneumonia;* S. 6 ozs. 220 grs.—XXXIV. *m.* 32. *Phthisis, Pleuritis,* Bright's disease; S. 8 ozs. 320 grs.—XXXV. *Acute Phthisis;* 6 ozs. 44 grs.—XXXVI. *m.* 73. Carbuncle; S. 4 ozs. 87 grs. This Spleen did not present the usual appearance in aged persons. A supplementary Spleen, the size of a horse-bean, connected with a tongue-like process of the Spleen, was present. (Plate 25 E.)—XXXVII. *Phthisis,* S. 13 oz.; L. 64 ozs. One large tubercle in the external centre of the Spleen. —XXXVIII. *f.* 18. Dropsy, sudden death; S. about 6 ozs. (See case in chapter on Pathology).—XXXIX. *m.* 50. *Mitral Valve* disease; S. 5 oz. 284 grs. This Spleen was nine lobed on its under surface, and had, besides, a supplementary Spleen of the size of a large nut; the blood of splenic artery and vein presented, when microscopically examined, no perceptible difference.—XL. *m.* 42, Cancer of Testicle; S. 6 ozs. 430 grs. (I am not positive as to which of the last two patients these Spleens belonged).—XLI. *f.* 70. Apoplexy; S. 2 ozs. 5 grs. XLII. *m.* 75. Retention of urine; S. 5 ozs. 5 grs. cartilaginous deposit on the capsule of the Spleen.—XLIII. *f.* 32. *Phthisis;* S. 4 ozs. 216 grs.—XLIV. *m.* 40. Cirrhosis of liver; S. 3 lbs. 2½ ozs. The Spleen dense and of an intense red colour (prep. 134.) Deposits of fibrine under the capsule in several places as in the preparation. Around these deposits the spleen substance was softer and of a darker colour. The coats of the veins very distinct, and the mouths of the smaller trunks open and large. The. spleen pulp only examined; the blood globules, were none of them white. (Plate 30 E.)—XLV. *m.* 30. S. 17 ozs.; Spleen simply hypertrophied. The patient, a Hawker, had been of intemperate habits. Slight recent inflammation of the liver and its capsule; slight tendency to hob-nail liver; tubercle in and upon pancreas; mottled and granular kidneys; chronic *Bronchitis* and *Emphysema.* Consistence of Spleen firmer than natural, and capsule thickened.—XLVI. *m.* 45. Enlargement of the Spleen; S. 2 lbs. 12 ozs. The spleen substance dense, with large patches of fibrinous deposit under the capsule. Small colourless crystals in the spleen-pulp. (Plate 29 E.)—XLVII. *f.* 55. Enlarged Spleen; S. 3½ lbs. (For case see chapter on Pathology.) XLVIII.—4 ozs. 320 grs.;—XLIX.—8 ozs. 25 grs.—L. *m.* 71. *Tubercles of the Lungs;* S. 3 ozs. 120 grs.

¶ The foregoing is copied from the table and from the descriptions under the drawings. All the Spleens are represented of their original size and colour; and the blood of the splenic artery and vein is generally placed upon the paper with the microscopical appearances underneath; but as the examinations were seldom made until some time after death, but little value can be attached to this mode of investigation. I may remark, however, that there was seldom any perceptible difference between the blood of the artery and the vein, as the drawings shew; indeed, in some cases I counted more white corpuscles in the arterial blood than in the venous. The bile is often exhibited in connexion with the blood, for the purpose of testing the correctness of Kölliker's theory, respecting the supposed decomposed blood corpuscles forming the coloring matter of the bile. In the last-mentioned 50 cases, there were two instances of supplementary Spleens, making five examples in the 69 cases. Under the chapter on Pathology, some of the morbid appearances will be alluded to. I abstained in the original table from giving the average weight of the Spleens, because the increased size of some of them might lead to an erroneous estimate; I may now state, however, that the average weight of the Spleens of the 46 adults last named, was about 5½ ozs.; the weight of the four largest spleens averaging 39½ ozs. It will be seen, moreover, that this organ in old persons, like most of the viscera, decreases in bulk.

The subjoined account of the condition of the Spleen and Liver in one-hundred and thirty-seven patients affected with pulmonary *Phthisis*, has been furnished by my friend, Mr. Vertue Edwards, House Surgeon to the Brompton Hospital; and the authorities of the Hospital have kindly given their sanction for its publication. When the condition of the lungs is not named, both were tuberculous.

I. *male*, æt. 16. Spleen, 5½ ozs., pale; Liver 34 ozs., congested.—II. *m.* 21. S. 7 ozs., very pale; L. 45 ozs., congested —III. *f.* 23. S. 4½ ozs.; L. 53 ozs., pale and greasy.—IV. *m.* 21. S. 5¾ ozs.; L. 44 ozs —V. *m.* 40. S. 5½ ozs.; L. 55 ozs.—VI. *f.* 20. S. 7 ozs.; L. 46½ ozs —VII. *f.* 30. S. 8 ozs., adhering to liver; left lung only diseased; L. 70 ozs.—VIII. *m.* 23. S. 11½ ozs.; L. 59 ozs., congested. —IX. *f.* 10. S. 3 ozs., no cavities in the lungs; L. 30 ozs., congested.—X. *f.* 32. S. 6½ ozs.; L. 51½ ozs., pale.—XI. *m.* 35. S. 13 ozs.; several masses of hard, yellow deposit in the Spleen, the size of a nut; right lung congested; crude tubercles and small cavities; L. 49 ozs.; serous surface studded thickly with tubercles.—XII. *m.* 33. S. 5½ ozs., L. 52 ozs., pale, soft, nutmeg-like.—XIII. *f.* 41. S. 6 ozs.; L. 61 ozs., pale, greasy, and adherent to diaphragm.—XIV. *m.* 30. S. 6½ ozs., congested; L. firm, congested; old adhesions to diaphragm.—XV. *m.* 34. S. 6½ ozs., congested; left lung congested, right, hepatized; L. 58 ozs., dull, yellow, and bloodless.—XVI. *m.* 36. S. 8½ ozs.; L. 49 ozs.—XVII. *m.* 31. S. 8½ ozs.; L. 73 ozs., firm and congested.—XVIII. *f.* 31. S. 3 ozs.; L. 36 ozs., nutmeg.—XIX. *m.* 29. S. 5¾ ozs., pale;

L. 76 ozs., gall-bladder small and empty.—XX. *m.* 29. S. 8½ ozs.; L. 56 ozs.—XXI. *m.* 35. S. 8½ ozs.; L. 66½ ozs.—XXII. *f.* 34. S. 4½ ozs., pale; *Pneumonia,* tubercles in right lung, cavity in the left; L. 62½ ozs., soft and congested.—XXIII. *m.* 45. S. 4¾ ozs., very pale; L. 57 ozs.—XXIV. *f.* 33. S. 4 ozs.; L. 44 ozs.—XXV. *m.* 26. S. 7 ozs.—XXVI. *m.* 31. S. 5¾ ozs.; L. 60 ozs.—XXVII. *f.* 29. S. 3½ ozs.; L. 62 ozs.—XXVIII. *m.* 45. S. 5½ ozs; L. 49 ozs.—XXIX. *m.* 23. S. 5½ ozs; cavity in the right lung, emphysema in the left; L. 46 ozs.—XXX. *m.* 35. S.—softened; L. 52 ozs.—XXXI. *m.* 27. S. 14 ozs.; tubercles in the right lung, cavity in the left; L. 98 ozs., pale and firm.—XXXII. *m.* 40. S. 5 ozs.; L. 64 ozs., pale.—XXXIV. *m.* 28. S. 4½ ozs.; L. 52½ ozs., pale.—XXXV. *m.* 36. S. 5½ ozs.; L. 48½ ozs.—XXXVI. *f.* 52. S. 4½ ozs.; L. 43½ ozs.—XXXVII. *m.* 34. S. 10½ ozs.; L. 48 ozs.—XXXVIII. *f.* 28. S. 5½ ozs.; L. 53½ ozs.—XXXIX. *m.* 25. S. 7½ ozs.; L. 61 ozs.; firmly adherent to surrounding organs, including spleen.—XL. *m.* 28. S. 8 ozs.; L. 49 ozs.—XLI. *m.* 49. S. 7 ozs.; L. 60 ozs., fatty.—XLII. *m.* 26. S. 3½ ozs.; L. 41 ozs.—XLIII. *f.* 44. S. 6 ozs.; cavity in right lung, *pneumonia* in left; L. 60 ozs.—XLIV. *f.* 16. S. 7½ ozs.; L. 39 ozs.—XLV. *f.* 13. S. 4½ ozs.; L. 36 ozs.—XLVI. *m.* 33. S. 9½ ozs.; L. 68 ozs.—XLVII. *m.* 27. S. 9 ozs.; small cavity in the right lung, grey tubercles in the left; L. 91 ozs., fatty.—XLVIII. *m.* 18. S. 4½ ozs.; L. 38½ ozs.—XLIX. *f.* 34. S. 6 ozs.; L 63 ozs., friable; Gall bladder empty.—L. *m.* 34. S. 5½ ozs.; L. 48 ozs.—LI. *m.* 26. S. 4 ozs.; died of softened brain—right lung congested, left crepitant; L. 41 ozs.—LII. *f.* 15. S. 3½ ozs., pale; L. 57 ozs., pale.—LIII. *m.* 47. S. 6 ozs.; L. 43 ozs.; hard, nutmeg.—LIV. *m.* 27. S. 8½ ozs., pale and flabby; L. 83 ozs., pale and fatty.—LV, *f.* 46. S. 4 ozs.; L. 39 ozs.—LVI. *m.* 24. S. 9 ozs.; L. 58 ozs., congested.—LVII. *f.* 22 S. 4½ ozs.; L. 52 ozs.—LVIII. *f.* 22. S. 4 ozs.; L. 48 ozs.—LIX. *m.* 45. S. 6½ ozs.; L. 68 ozs., nutmeg.—LX. *f.* 26. S. 3 ozs.; L. 51 ozs.—LXI. *m.* 28. S. 8 ozs.; L. 49 ozs.—LXII. *f.* 17. S. 2½ ozs.; L. 48 ozs.—LXIII. *f.* 33. S. 4½ ozs.; L. 50½ ozs.—LXIV. *m.* 30. S. 6½ ozs.; L. 58 ozs., friable.—LXV. *f.* 17. S. 3½ ozs.; L. 42 ozs.—XLVI. *m.* 37. S. 5½ ozs., rather soft; L. 55 ozs., granular.—LXVII. *m.* 18. S. 5½ ozs., rather soft; L. 49 ozs.—LXVIII. *m.* 22. S. 7½ ozs., slightly softened; L. 54 ozs.—LXIX. *f.* 36. S. 5½ ozs., slightly congested; L. 51½ ozs.; 4 gall-stones in gall-bladder.—LXX. *m.* 45. S. 6 ozs., softened; L. 42 ozs., hob-nailed. LXXI. *m.* 27. S. 11 ozs., soft and engorged; gall-stones; L.

—LXXII. *f.* 38. S. 4 ozs., soft and engorged; L. 36 ozs., congested and friable.—LXXIII. *f.* 29. S. 7 ozs., soft and engorged; L. 45 ozs. LXXIV. *f.* 32. S. 4 ozs, almost rotten; cavity in right lung, tubercles in the left; L. 52 ozs., very fatty.—LXXV. *f*, 19. S. 6½ ozs., rather congested; L. 50 ozs.—LXXVI. *m.* 43. S. 8 ozs., soft; a few tubercles in the lungs, and aneurism of the aorta; L. 69½ ozs., much congested.—LXXVII. *f.* 33. S. 5½ ozs., friable, very soft; L. 45 ozs., pale.—LXXVIII. *m.* 19. S. 4½ ozs., friable; L. 56 ozs., congested.—LXXIX. *m.* 30. S. 9½ ozs.; L. 45½ ozs.—LXXX. *m.* 20. S. 4½ ozs.; L. 46 ozs., pale and soft.—LXXXI. *f.* 20. S. 3 ozs.; L. 37½ ozs.—LXXXII. *m.* 26. S. 6½ ozs.; L. 48 ozs., rather soft.—LXXXIII. *m.* 33. S. 9½ ozs.; L. 71 ozs., pale.—LXXXIV. *f.* 13. S. 3 ozs.; L. 32 ozs.—LXXXV. *f.* 50. S 2½ ozs., much atrophied and congested; cancer of lungs, &c.; two gall-stones; L. 40 ozs.—LXXXVI. *f.* 26. S. 3 oz., very soft; L. 57 oz., firm.—LXXXVII. *m.* 39. S. 11½ ozs. L. 47½ oz., firm.—LXXXVIII. *f.* 18. S. 7 ozs., firm; L. 62 ozs., pale and nutmeg-like.—LXXXIX. *m.* 29. S. 6½ ozs., firm; L. 71 ozs. —XC. *f.* 22. S. 5 ozs.; L. 48½ ozs.—XCI. *m.* 31. S. 8½ ozs., firm; L. 90 ozs.—XCII. *m.* 52. S. 3½ ozs.; L. 32½ ozs., congested. —XCIII. *f.* 22. S. 4½ ozs.; L. 42½ ozs., pale and soft.—XCIV. *m.* 40. S. 13½ ozs., firm; L. 64 ozs., firm.—XCV. *m.* 32. S. 14½ ozs.; L. 62 ozs., fatty.—XCVI. *m.* 20. S. 8½ ozs., much softened. L. 46 ozs., soft.—XCVII. *f.* 32. S. 6½ ozs.; L. 43½ ozs., friable.—XCVIII. *m.* 23 S. 11½ ozs.; L. 59 ozs., nutmeg.—XCIX. *m.* 30. S. 93¼ ozs.; L. 76 ozs., fatty. — C. *m.* 25. S. 5½ ozs., soft and grumous; L. 43½ ozs.—CI. *f.* 21. S. 4 ozs.; L. 42½ ozs., fatty; gall-stones also.—CII. *f.* 19. S. 5¾ ozs.; L. 47 ozs., fatty.—CIII. *m.* 27. S. 4½ ozs.; L. 56 ozs.—CIV. *m.* 22. S. 3½ ozs., rather soft; L. 41 ozs., flabby.—CV. *m.* 28. S. 9½ ozs.; L. 88 ozs., fatty.—CVI. *m.* 29. S. 11½ ozs., contained in its substance two nodules of yellowish white matter, of firm consistence, which under the microscope were seen to consist of granular matter, with a few cells sparingly scattered. Heart flabby and in a state of fatty degeneration. The upper part of kidney a mass of solid tubercular matter—two nodules as in spleen; L. 62 ozs.—CVII. *m.* 41. S. 4½ ozs.; it contained several small masses of tubercle; L. 49 ozs.—CVIII. *m.* 20. S. 9½ ozs., soft and flabby; L. 68 ozs., flabby and fatty.—CIX. *m.* 28. S. 9 ozs., cavity in right lung; emphysema of left; L. 67 ozs.—CX. *m.* 19. S. 5½ ozs., soft; L. 56 ozs., flabby and greasy.—CXI. *f.* 8. S. 4½ ozs.; L. 36 ozs., fragile and granular.—CXII. 12 or 14. S. 1½ oz.; L. 30 ozs., fragile.—

CXIII. *m.* 17. S. 5½ ozs.; L. 47 ozs.—CXIV. *m.* 30. S. 7½ ozs. There were four or five hard yellowish white masses, the size of pin's heads on the surface; L. 64 ozs., fatty.—CXV. *m.* 44. S. 3½ ozs.; L. 39 ozs.—CXVI. *m.* 33. S. 3¾ ozs.; L. 45 ozs., brittle and granular.—CXVII. *m.* 10. S. 3 ozs.; L. 27 ozs.—CXVIII. *f.* 42. S. 8 ozs., firm; L. 24 ozs.—CXIX. *m.* 22. S. 6½ ozs.; L. 62 ozs. fatty.—CXX. *m.* 20. S. 6. ozs., firm; L. 53 ozs, rather fatty.—CXXI. *f.* 18. S. 3½ ozs., rather pulpy; L. 42½ ozs., flabby and greasy.—CXXII. *m.* 23. S. 6 ozs., heart disease; L. 70 ozs.—CXXIII. *f.* 37. S. 7½ ozs., curved round the fundus of the stomach; L. 41½ ozs.—CXXIV. *m.* 34. S. 5½ ozs.; L. 50 ozs., fatty and pale.—CXXV. *m.* 45. S. 6 ozs.; it contained several small masses of tubercles; L. 48 ozs.—CXXVI. *m.* 24. S. 4½ ozs.; L. 46 ozs.—CXXVII. *f.* 42. S. 6½ ozs.; L. 67 ozs., pale.—CXXVIII. *m.* 19. S. 7 ozs.; L. 68 ozs., firm.—CXXIX. *f.* 26. S. 5½ ozs.; L. 64 ozs.—CXXX. *f.* 33. S. 6 ozs.; L. 38 ozs.—CXXXI. *m.* 33. S. 8 ozs. flabby.—CXXXII. *f.* 17. S. 6½ ozs., peculiarly firm, and of a very bright colour; L. 36 ozs.—CXXXIII. *m.* 41. S. 6½ ozs., firm; L. 80 ozs.—CXXXIV. *f.* 30. S. 8¾ ozs.; L. 37 ozs. —CXXXV. *m.* 23. S. 5 ozs., firm; L. 64 ozs.—CXXXVI. *m.* 40. S. 6 ozs.; L. 48 ozs.—CXXXVII. *f.* 30. S. 4 ozs.; L. 56 ozs.

¶ For an account of the abbreviations I again refer the reader to page 50. In the Essay the above are in a tabular form, and I made no analysis of the cases (for want of time), but it will not be unprofitable, I think, to add some statistical deductions from the above interesting evidence, and to compare the results with those deduced from the other tables. I scarcely need add, that Mr. Edwards supplied me only with such abstracts as related especially to the pathology and physiology of the Spleen. The reader will agree with me, that this mode of registration does much credit to the Physicians of the Hospital, and that it is likely hereafter to lead to great practical benefit.

DEDUCTIONS.

¶ In the above 130 cases of Phthisis, the Spleen was weighed in all; the greatest weight being 14½ oz.; the smallest, 1½ oz. (the patient being 12 or 14 years of age). In four patients, between 10 and 12 years of age, the average weight of the Spleen was about 3 ozs.; of the Liver, about 31 ozs. In 12 patients, between 17 and 20, the average weight of the Spleen was about 5¼ ozs.; of the Liver, about 50¼ ozs. In the remaining 114 patients, all of whom, with two exceptions, were between 20 and 45 years of age, the average weight of the Spleen in 112 instances, was nearly 6½ ozs.; in two, it was not weighed. The Liver was weighed in 110 cases, and averaged nearly 54¼ ozs. As the weights are not given in grains, the estimates are not quite accurate, but they are sufficiently so for physiological deductions, which will be found in the Chapter on Pathology.

A Table of 29 *post-mortem* examinations, giving generally the weight of the Spleen; the morbid appearances, with a general summary of the

weight of the thoracic and abdominal viscera, kindly furnished by my friend, Dr. T. S. Holland, of Cork, who performed all the autopsies, and weighed the different organs himself.

I. *m.* Body 5 ft. 11 ins. in length, very muscular; cavities in the right lung; S. healthy, $5\frac{1}{4}$ ozs.—II. *m.* 55; Inguinal hernia on both sides; S. healthy, $2\frac{3}{4}$ ozs.—III. *m.* 45; 5 ft. 6 in.; lean; softened tubercles in both lungs; vast abscess between the base of the left lung and the diaphragm; S. healthy, $2\frac{3}{4}$ ozs.; four lymph spots on its serous covering, where it was in contact with the diaphragm.—IV. *f.* 25; 5 ft. 3 ins.; corpulent, death from effusion into the left pleural cavity; S. healthy, 5 ozs.; a second Spleen, the size of a Brazil nut.—V. *m.* 30; 5 ft. 4 ins.; rather muscular; two abscesses in the left kidney; S. normal, 6 ozs.—VI. *f.* 30; 5 ft. 2 ins.; emaciated; abscess under the left breast; cavities in the left lung; S. healthy, $5\frac{1}{2}$ ozs.—VII. *m.* 10; 4 ft.; tubercles throughout every part of both lungs; S. healthy, $3\frac{3}{4}$ ozs.—VIII. *f.* 60; 5 ft. $1\frac{1}{2}$ in., 12 ozs. of fluid in the left pleura; mucous membrane of the small intestines red and pulpy; no ulceration; no enlargement of mesenteric glands; S. normal, $2\frac{3}{4}$ ozs.—IX *m.* 5 ft. 10 ins.; lean, but muscular; 12 ozs. of fluid in the right pleura; patency of, with calcareous deposit on the aortic valves; S. decomposing, $6\frac{3}{4}$ ozs.—X. *f.* 35; 5 ft.; cavities in the apices of both lungs; S. healthy, $4\frac{1}{4}$ ozs.; the glands lying along the spinal column, looked like a series of little Spleens, and gave under the microscope—1st, a fluid full of yellowish red granules; 2nd, altered blood corpuscles, and a structureless membrane, in many parts coiled on itself; stomach and intestines healthy.—XI. *f.* 36; 5 ft. 6 ins.; plump; both lungs highly emphysematous; heart, 13 ozs.; healthy; calculus in gall-bladder; right ovary contained 2 ozs. of clear fluid; S. apparently healthy, 8 ozs.—XII. *f.* 33.; 5 ft. 2 ins.; robust; all the viscera gorged with blood; S. like a dense blood-clot, $5\frac{1}{4}$ oz.—XIII. *f.* 60; 5 ft. 4 in., emaciated; small cavities in both lungs; fatty liver (anasarca of lower extremities) S. normal, $3\frac{1}{4}$ ozs.—XIV. *f.* 65; 4 ft. 8 in.; calcareous ring round the right auriculo-ventricular orifice; one of the divisions of the mitral valve firmly fixed against the outer walls of the ventricle; gall-stone the size of a filbert; cyst in each kidney; S. normal, $1\frac{1}{4}$ ozs.—XV. *m.* 12; 4 ft. rather emaciated; small hard tubercles scattered over both lungs; no cavities; calculus in pelvis of kidney; mesenteric glands enlarged, and containing scrofulous deposit; S. pulpy; white spots on its surface, 4 ozs.—XVI. *f.* 7.; very emaciated; large tubercles in the apices of both lungs; some of the mesenteric glands larger than a walnut; transverse ulceration in the large intestines; S.

normal, 4 oz. 1 drachm.—XVII. *f.* 18; 5 ft. 1 in.; well developed; fever; left lung solid; S. 8¾ oz.; harder than natural.—XVIII. *f.* 14. 4 ft. 8 in.; robust; 8 oz. of bloody serum in right pleura; S. 7¼ oz., denser than usual, and adherent to diaphragm.—XIX. *m.*, 48, 5 ft. 7 in. (dead 72 hours), S. 4¼ ozs.; very much decomposed.—XX. *f.* 45; 4 ft. 11 in.; fatty liver; stomach and intestines congested; S. healthy, 3¾ ozs. —XXI. *m.* 36; 6 ft. 1 in.; muscular; both kidneys were in a state of acute nephritis; right, 6½ ozs., left, 7¼; S. 10 oz.; triangular in shape. Its serous covering could readily be peeled off; it was not wrinkled, but dense and shining like bees wax. On microscopical examination, I found all its minute structures larger than natural. It appeared to be simple, persistent hypertrophy.—XXII. *m.* 55; 5 ft. 4½ ins.; emaciated; died of *Diabetes;* S. 1 oz. 20 grs.; microscopic structure very minute, but apparently healthy; persistent atrophy.—XXIII. *m.* 5 ft. 1 in.; emaciated; fatty liver; contraction of mitral valve so as to allow of regurgitation into the auricle; S. large, soft; serous covering wrinkled, 9½ ozs.; healthy non-persistent hypertrophy.

Six cases in which the condition of the Spleen is given without the organ having been weighed.

XXIV. *m.* Lunatic; several sores on hips; S. large but healthy.—XXV. *m.* 48, very emaciated; cancerous ulceration of great curvature of the stomach, with partial destruction of the pancreas; S. soft, full sized; two small supplementary Spleens like glands between the layers of the mesentery.—XXVI. *m.* 50; 5 ft. 6 ins.; muscular; dead 48 hours; hepatization of the lower lobe of right lung; spleen adherent to diaphragm; its substance soft, as if decomposing.—XXVII. *m.* 62; 5 ft. 6 ins.; very muscular; dead 18 hours; all the organs healthy; S. soft, semifluid, and although it was not quite cold, it had, as in the last case, appearance of decomposing.—XXVIII. *m.* 8; 3 ft. 10 ins; emaciated; dead 24 hours; tubercles in both lungs; bronchial glands as large as a walnut, and in a state of scrofulous degeneration; S. healthy; Malpighian bodies larger than usual.—XXIX. *m.*; double bronchitis; recent intense pericarditis; S. gorged with blood, but apparently healthy.

The examinations were made between January and May, 1852. The following table is a summary of the weight of the thoracic and abdominal viscera, by Dr. Holland. As the above numbers differ often from those in the Registry of the cases, the reader must observe the following:—Nos 1 and 2, the same. No. 3 corresponds with No. 4—4 with 5—5, 6—6, 7—7, 8—8, 10—9, 12—10, 13—11, 14—12, 15—13, 16—

14, 17—15, 22—16, 24—17, 26—18, 27—19, 28—20, 30, 21, the same—22, 25.

General Summary of the weight of the Thoracic and Abdominal Viscera.

No. in Registry.	Heart.	Liver.	Kidney. Right.	Kidney. Left.	Spleen.
1	12½ ozs.	4 lbs. 1 oz.	7¾ ozs	7 ozs.	5¼ ozs.
2	7½ „	2 „ 12 „	3¾ „	4¼ „	2¾ „
4	6½ „	2 „ 4½ „	3½ „	3¼ „	2¾ „
5	7¾ „	4 „ 0¾ „	3½ „	3½ „	5 „
6	8 „	3 „ 0 „	7¾ „	9 „	6 „
7	8½ „	2 „ 7 „	4½ „	5 „	5½ „
8	5 „	1 „ 13 „	3½ „	3½ „	3¾ „
10	—	1 „ 11 „	4¾ „	5¼ „	2¾ „
12	14 „	3 „ 3 „	4¼ „	4⅛ „	6¾ „
13	6¾ „	2 „ 10 „	4 „	3¼ „	4¼ „
14	13 „	3 „ 15½ „	5¾ „	5¾ „	8 „
15	10½ „	2 „ 12½ „	4½ „	5¼ „	5¼ „
16	7¼ „	3 „ 1½ „	4¼ „	3¼ „	3¼ „
17	—	—	4¼ „	4 „	1¼ „
19	10¼ „	2 „ 14½ „	3¼ „	3¼ „	very soft.
20	10¼ „	2 „ 12½ „	3¾ „	3¾ „	ditto.
21	8¾ „	3 „ 3½ „	6½ „	7¼ „	10 ozs.
22	4¾ „	2 „ 1 „	3¾ „	3¾ „	4 „
23	6 „	2 „ 6½ „	3 „	2¾ „	—
24	3½ „	2 „ 12 „	2¾ „	2¾ „	4 oz. 60 grs.
25	10 „	2 „ 13 „	—	—	1 „ 20 „
26	8¾ „	2 „ 11 „	3½ „	4¼ „	8¾ ozs.
27	5¼ „	2 „ 7½ „	4 „	3 ozs. 7 ds.	7¼ „
28	9¾ „	—	4¼ „	4¼ ozs.	4¼ „
29	—	—	2¼ „	2¼ „	—
30	—	2 „ 2 „	3¾ „	3¾ „	3¾ „
General Average	ozs. 8.38,636	ozs. 37.837	ozs. 4.26	ozs. 4.18	ozs. 4.18

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In the above estimate, it must be borne in mind that the numbers 8, 22, 23, 24, and 27, refer to patients under 14 years of age.

COMPARATIVE ANATOMY OF THE SPLEEN.

I now proceed to glance at some of the peculiarities of the various classes of animals that have not been specially alluded to; my remarks bearing more particularly upon those peculiarities of structure and function, which relate to the Spleen.

QUADRUMANA.

The Monkeys present no important deviation from the structure of man, and their digestive apparatus bears a great resemblance to that of the human species. Although generally described as vegetable feeders, they no doubt destroy many of the smaller animals for their food. Plate 1, E., which represents the abdominal viscera of the *Ourang Outan,* and the dry preparation of the intestines, (17*a*,) shew the remarkable resemblance which some parts of the structure of this animal bear to that of man. The Liver, however, is bi-lobed only, but the Spleen, with the exception of its more elongated form, is much like that of the human species. The 30 Spleens of the Monkeys, (as shewn in Plates 1 to 9, *Quadrumana* E,) will illustrate the various deviations in form of this organ, (see Plate 2, fig. 1 to 18.) In the Macaque Monkey, (Plate 7 E,) the Stomach is of an immense size. The trabeculæ, (Plate 8,) are very similar to those of the *Bimana,* and the blood and spleen-pulp are nearly the same, (Plate 8, E). The Spleen of the Lemur is more elongated, and the ends in some, broader than in the Monkey. (Plate 2, figs. 20, 21.) The arrangement of the blood vessels, nerves, and absorbents differs in no way, so far as my examinations have gone, from that of man.

The weight of the viscera in this, and in nearly all the following Tables, is given in grains, and when the cause of death is not named, it was unapparent. It is unnecessary *here* to give the length of the body of the animals, and the Latin names are not *repeated.*

1. Ourang Outan. (*Pithecus Satyrus, Asia,*) Age 4 years; thin; C. D. Diarrhœa; weight $19\frac{1}{2}$ lbs.; S. $\frac{1}{312}$; L. $\frac{1}{22}$; P. $\frac{1}{1525}$; K. $\frac{1}{297}$; H. $\frac{1}{198}$; Lgs $\frac{1}{122}$; A.C. 17 ft. 7 ins; length of body 18 ins. The thoracic and abdo-

minal viscera weighed $3\frac{1}{2}$ lbs ; the Alimentary Canal held 4 pints of water. The weight of the viscera has been already given at page 25.

2. *Barbary Ape*, 2 months old ; *Pneumonia* of right lung. For weight of viscera, see page 25. The subjoined are their proportions to the body.— S. about 176 ; L. 16 ; K. 146 ; H. 128; Lgs. 54 ; A. C. 5 ft. 11 ins.

3. *Chacma Baboon, (Africa.)* Thin. Tubercles of Lungs and Spleen. B. 14 lbs. ; S. 230 $\frac{1}{428}$; L. 2560 $\frac{1}{38}$; K. 330 $\frac{1}{298}$; H. 560 $\frac{1}{176}$; Lgs. 890 $\frac{1}{110}$; A. C. 10 ft. 8 ins.

4. *Col Sykes' Monkey*, (*India.*) C. D., doubtful. B. 3 lbs. 12 ozs.; S. 35 $\frac{1}{754}$; L. 860 $\frac{1}{30}$; K. 65 $\frac{1}{406}$; H. 190 $\frac{1}{138}$; Lgs. 280 $\frac{1}{94}$; A. C. 10 ft. 6 ins.

5. *White Throated Monkey, (Albogularis,) Mozambique.* Tubercles in the Spleen and liver ; a few in the lungs. B. 12 lbs. ; S. 285 $\frac{1}{296}$; L. 5,280 $\frac{1}{16}$; K. 270 $\frac{1}{312}$; H. 492 $\frac{1}{171}$; Lgs. 1,340 $\frac{1}{63}$; A. C. 8ft. 9 ins.

6. Toque. *(M. radiatus, India).* Tuberculated lungs ; B. $8\frac{1}{4}$ lbs. ; S. 134 $\frac{1}{380}$; L. 2,320 $\frac{1}{22}$; P. 55 $\frac{1}{928}$; K. 250 $\frac{1}{204}$; H. 290 $\frac{1}{176}$; Lgs. 2,643 $\frac{1}{20}$; A. C. 10 ft. 9 ins.

7. Jos Monkey. *(S. hamadryas, Asia.) Pneumonia.* B. $5\frac{1}{2}$ lbs. ; S. 140 $\frac{1}{276}$; L. 1,463 $\frac{1}{26}$; P. 25 $\frac{1}{1548}$; K. 210 $\frac{1}{184}$; H. 310 $\frac{1}{124}$; Lgs. 500 $\frac{1}{77}$; A. C. 11 ft. 1 in.

8. *Cetus.* Tuberculated lungs ; B. $3\frac{1}{2}$ lbs. ; S. 60 $\frac{1}{410}$; L. 820 $\frac{1}{30}$; P. 1,232 $\frac{1}{20}$; K. 77 $\frac{1}{320}$; H. 180 $\frac{1}{136}$; Lgs. 1,410 $\frac{1}{17}$; A. C. 9ft. 1in.

9. Moustache Monkey. *(S. cephas, Guinea).* B. $7\frac{1}{2}$ lbs. ; S. about 400 $\frac{1}{132}$; L. 2,700 $\frac{1}{19}$; P. about 130 ; K. 175 $\frac{1}{301}$; H. 525 $\frac{1}{100}$; Lgs. 1,120 $\frac{1}{47}$; A. C. 9 ft. 5 ins.

10. Mona Monkey. *(S. mona, Africa).* B. 3 lbs. 9 ozs. ; fat ; S. about 180 $\frac{1}{139}$; L. 800 $\frac{1}{31}$; K. 66 $\frac{1}{380}$; H. 114 $\frac{1}{220}$; Lgs. 240 $\frac{1}{104}$; A. C. 7 ft. 4 ins.

11. Red Monkey. *(C. ruber, Senegal). Fungus* Hæmatodes of the left lung ; the Spleen normal. B. $5\frac{1}{2}$ lbs. ; S. 300 $\frac{1}{129}$; L. 2,740 $\frac{1}{14}$; K. 240 $\frac{1}{160}$; H. 389 ; $\frac{1}{99}$; Lgs. diseased ; A. C. 14 ft. 10 ins.

12. Green Monkey. *(C. Sabæus, Senegal).* B. 5 lbs. ; S. 100 $\frac{1}{352}$; L. 2,000 $\frac{1}{17}$; H. 350 $\frac{1}{100}$; Lgs. 510 $\frac{1}{69}$; A. C. 10 ft. 7 ins.—13. No. 2. Tuberculated intestines and Spleen. B. 3 lbs. 6 ozs. ; S. 160 $\frac{1}{148}$. —14. No. 3. *Pneumonia.* B. 8 lbs. ; S. 70 $\frac{1}{804}$.—15. Vervet. *(C. pygerythræus, Africa.)* Young. B. 4 lbs. ; S. 211 $\frac{1}{133}$.—16. (*Macacus Silenus, Ceylon).* B. 5 lbs. 12 ozs. ; S. 221 $\frac{1}{183}$.—17. Pig-faced Baboon. *(C. porcarius, Africa).* B. about 40 lbs. ; S. 600 $\frac{1}{460}$.—18. Marmoset. *(Jacchus, S. America).* B. 9 ozs. ; S. 12 $\frac{1}{330}$; L. 180 $\frac{1}{22}$; K. 14 $\frac{1}{282}$; H. 43 $\frac{1}{92}$; Lgs. 84 $\frac{1}{47}$; A. C. 3 ft. 2 ins.

19. Spider Monkey (*Ateles, South America*). Fatty liver; B. 4 lbs.; S. 73 $\frac{1}{383}$; L. 1,330 $\frac{1}{21}$; K. 128 $\frac{1}{220}$; H. 325 $\frac{1}{83}$; Lgs. 450 $\frac{1}{62}$; A. C. 8 ft. 1 in.

In the above 19 animals, the Spleen was tuberculated in Nos. 3, 5, 13. In 4, the cause of death was doubtful. The specimens, Nos. 1, 3, 8, 13, were thin; the remainder in good or in tolerable condition.

LEMURIDÆ.

20. White-fronted Lemur. (*L. Albifrons, Madagascar*). B. 4 lbs., very fat; S. 80 $\frac{1}{352}$; L. 1,435 $\frac{1}{19}$; P. about 60; K. 90 $\frac{1}{312}$; H. 340 $\frac{1}{82}$; Lgs. 380 $\frac{1}{74}$; A. C. 9 ft. 3 ins.—21. Ring-tailed Lemur. (*L. Catta*). Ruptured stomach; fatty liver. B. 3 lbs.; S. 80 $\frac{1}{264}$; L. 885 $\frac{1}{23}$; K. 110 $\frac{1}{192}$; H. 180 $\frac{1}{117}$; Lgs. 270 $\frac{1}{78}$; A. C. 9 ft. 5 ins.—22. Yellow Lemur. (*L. rufus*). B. 2½ lbs.; S. about 60 grs. $\frac{1}{293}$. 23. *Loris Nycticebus*, (*L. tardigrda, India*). Very thin. (See page 25;) S. about 1 $\frac{1}{117}$.

In Plate 9, (*Quadrumana* E,) I have sketched ten Spleens from animals in spirit in the College Store-room. 1. Marmoset, two days old; the Spleen weighing about 2 grs.—2. A large Chimpanzee; S. about 2 ozs. —3. A young Chimpanzee, weighing 3 lbs.; the S. about 70 grs.—4. Another, about 12 lbs.; S. about 2½ ozs.—6. A young Gibbon (*S. lar*) Coromandel, weighing 4 lbs.; S. about 65 grs. I may mention, as this Spleen is not represented in Plate 2, that it is oblong, somewhat triangular, with four notches on the inner side.—7. *Simia Satyrus* (Oran); the Spleen as in Plate 2 fig. 1; the viscera only preserved.—8. Toque, 1 lb. 11 ozs.; S. 23 grs.—9. Proboscis Monkey; (*S. nasica, Borneo.*) Very rare. The Spleen of this monkey forms nearly an equilateral triangle.— 10. Young Lemur; B. 3 ozs.; S. about 5 grs.

I weighed all the bodies of these animals under 5 lbs.; but little dependence can be placed however upon the examination of animals in spirits as regards the relative weight of the organs.

¶ Besides the above, I have since examined the following; but with the exception of a few of the rarer animals, I shall only give in this Treatise the *proportionate* weight of the Spleen to the body. The undermentioned are the *relative* weights.

24. Chimpanzee. No. 1. *Diarrhœa.* B. 14 lbs.; S. 122; L. 19; P. 612; K. 196; H. 125; Lgs. 79; A. C. 16 ft. 2 ins.—25. No. 2. *Diarrhœa.* B. 20 lbs.; S. 176; L. 25; P. 885; K. 227; H. 220; Lgs. 68; A. C. 18 ft. 6 ins.—26. No. 3. *Pneumonia*, B. 9½ lbs.; S. 210; L. 20; P. 868; K. 158; H. 144; Lgs. 29; A. C. 15 ft. 11 ins. These animals were all in the Regent's Park Gardens, their ages varied from 2 to 4 years, and they were all teething.

¶ 27. Young Verret, at birth, B. 8 ozs.; S. 502; L. 35; K. 352; H. 167; Lgs. 54; Brain 7¼.—28. Silky Tamarin, (*J. leoninus, South America*). B. 15 ozs.; S. 550; L. 29; K. 24; H. 188; Lgs. 153.—29. Barbary Ape. No. 2. B. 25¼ lbs.; died of *Tetanus;* S. 741.—30. Diana Monkey. (*C. Diana, Africa*). S. 249.—31. Toque. No. 2. S. *about* 184.—32. Green Monkey. No. 4. S. 550.—33. Red Monkey. No. 2. S. double its natural size and full of small tubercles; liver fatty, but it contained no tubercles.—34. Pig-tailed Baboon. (*M. Rhesus, India.*) Lungs, Liver, and Spleen tuberculated; S. 101.—35. Brown Baboon. (*M. nemestrinus, Java*), S. 224. *Three supplementary Spleens.*—36. *Bonneted Monkey.* (*Albino, Cercopithecus —? Borneo*). Epileptic fits. S. 657.—37. Nestor Monkey. (*Africa*). Large stomach; S. 715.—38. Pluto Monkey. Aneurism of the aorta; S. 657.—39. Sutty Mangebey. (*C. fuliginosus, Africa*). S. 357.—40. No. 2. S. 352. —41. Spectacle Sapajou. (*C. lunatus, S. America.*) S. 410.—41. Marmoset. No. 2. S. $\frac{1}{132}$.—42. Capuchin. (*C. capuchinus, Guiana.*)

AVERAGES.

¶ The proportion of the Spleen to the body, in the 19 monkeys in the first table, is *about* 1-327—of the 3 Lemurs, 1-303—of the 20 monkeys in the last table, about 392; (the 10 specimens in the college collection are not estimated). So that assuming the Spleen of a healthy man to bear the proportion of 1-373 to the body, and deducting the enlarged and diseased Spleens of the monkeys from the above estimate, the relative weight is greater in the *Quadrumana* than in man; but its relative size in animals living in a state of nature has yet to be determined. Assuming that the weight of the human viscera are as stated at page 24, the following will be about the relative proportion to the body in man:—S. 373; L. 41; P. 995; K. 497; H. 248; Lgs. 40; Brain 1-45; and taking the average of six of the most healthy monkeys in the above table, the estimate is S. 300; L. 23.; P. 1058; K. 226; H. 145; Lgs. 84. In many monkeys, I find the brain relatively larger than in man. I could occupy many pages in describing the visceral anatomy of the Quadrumana, but I will allude only to one point that bears especially upon the physiology of the Spleen. I have examined the splenic and portal vessels in the Chimpanzee and other monkeys, with great care, and I find the arrangement generally very similar to that in the human subject. From four to nine veins pass from the stomach to the splenic veins; none of these enter the Spleen, but their distension must influence considerably the flow of blood from this organ. Possibly, under certain conditions of the liver, spleen, and stomach, the blood from the coronary veins may find its way into the Spleen. I have never found valves in the portal circulation of any of the *Quadrumana.*

PLATES.

¶ The Spleens of the *Quadrumana* are represented in Plate2, figs. 1 to 21. The length is *first* given in lines (12 to the inch), and next the breadth,—fig. I. Oran, 42-24.—II. Chimpanzee, 45-26.—III. Young Barbary Ape, 21-7.—IV. Togue, 20-7½.—V. Dogfaced Baboon, 20-12.—VI. Green monkey, 18-8.—VII. Another species, 21-12.—VIII. Chacma baboon, 33-21.—IX. Bonneted Monkey, 33-15.—X. Moustache, 33-14.—XI. Marmoset, 10-2½.—XII. Sykes', 21-8.—XIII. Toque, 24-12.—XIV. Jos, 28-14.—XV. *Rhesus*, 16-6.—XVI. *Cetus*, 18-9.—XVII. Macaque, 24-14.—XVIII. Pig-faced Baboon, 46-24.—XIV. Macaque (*Silenus*), 26-13.—XX. Yellow Lemur, 34-6. XXI. 36-7.—XCIX. *Loris Nycticebus*, 18-6.

CHEIROPTERA.

The Spleen of these animals bears a great resemblance to that of the Rodents, the Bats corresponding in some respects with their external character.

In the Table, I have given only the examination of 55 specimens of the long-eared Bat, (*Plecotus auritus;*) these animals were dissected in October, and the weight of all was about the same; some of them were very fat; the fat in the abdomen and pelvis of one weighed 18 grs. The subjoined are the relative weights of the viscera of one specimen from the table, in grs.: B. 132; S. $\frac{1}{2}$ or $\frac{1}{3}$, about $\frac{1}{300}$; L. $5\frac{1}{2}$ $\frac{1}{24}$; K 1 $\frac{1}{132}$; H. $1\frac{1}{2}$ $\frac{1}{88}$; Lgs. 2 $\frac{1}{66}$; A. C. $4\frac{1}{2}$ ins. (Prep. 185.)

In this animal the Malpighian corpuscles are very distinct, as shown in Plate 1, fig. 2 E; and in Plate 3 of this Treatise. Under a power of 60 diameters, they are plainly seen as yellowish, round, semi-transparent bodies, containing granular elements.

I examined also several specimens of *foreign* Bats in the store-room of the College of Surgeons. They are figured in Plate 2 E, and likewise in Plate 2 of this Treatise; the size is reduced, but the undermentioned are the proportions in lines, the length being *first* stated.

Plate 2.

Figure 22. *Plecotus auritus*, 4. $1\frac{1}{4}$.—23. *Pteropus. Moluccas*, 23. 5.—24. *Galeopithecus*, 15. $3\frac{1}{2}$.—25. Chinese Bat, 10. $1\frac{1}{2}$.—26. *Vespertilio Noctula*, 12. 2.—27. Nycterin, 11. 4.—28. Plecotus, 7. 3.—29. African Bat, 5. 2.—30. *P. Javanicus*, 3. $2\frac{1}{4}$.

¶ I have since dissected several of our English Bats, and the subjoined are the relative proportions to the body of some of them. No. 1. Mouse Bat, (*V. pipistrellis*,) 270.—No. 2. 240.—No. 3. 348. Long-eared Bat, (*P. auritus*). No 1. 255.—No. 2. 540.—No. 3. 320. Great Bat, (*V. noctula*). S. 255; L. 25; K. 170; H. 102; Lgs. 85; A. C. 14 ins. Last year I examined the body of a large *Pteropus*, (*P. Javanicus*), almost immediately after its death; the Spleen of this fruit-eating Bat was of a rounded form, and seated as in all the *Cheiroptera*, on the left side of the stomach; the animal weighed $15\frac{1}{2}$ ozs., the body 11 ins., and the measurement 3 ft. 6 ins. from the tip of each wing. Here are the proportions of the viscera to the body; S. 2,273; L. 37; K. 133; H. 158; Lgs. 106; A. C. 7 ft. 5 ins. The animal had probably not fed during its voyage to England.

CARNARIA.

The Spleen of the Carnaria is placed more or less transversely, and seated on the lesser and lower part of the stomach; the smaller end pointing often towards the right side. In a lioness (Prep. 36), I found this organ seated transversely, the right extremity being nearer to the abdominal walls than the left; but this animal had a

large quantity of hay in its stomach, and had suffered from violent spasm, which appeared to cause its death. In this class (the dogs, cats, and bears, especially) the gastro-splenic omentum is loaded with fat. In the lion, tiger, and leopard (Preps. 37, 38, and 39), the fat will be seen hard and solid; and in the hybernating bears, is very abundant,

The shape of the Spleen (see Plates of *Carnaria*) is much alike in the flesh-feeding animals. It is long and narrow, with the upper end from $\frac{1}{4}$ to $\frac{1}{3}$ larger than the lower. The edges are generally thin, its centre thick and convex on the under part; there being a slight sulcus where the vessels enter. In some animals it is slightly curled round at the extremities (dog p. 166); in others it is more or less notched, as in sun bear, otter, badger, civet cat, lynx, and wild cat. (Plates 3, 4, 5, 17, and 19 E.)

It is more than probable that many of these notches are deviations from the general form. Thus, in three otters that I examined, one had the end of the Spleen divided to the extent of an inch, whilst in the others, no notches existed. In the wild cat, (Plate 19), the organ is nearly divided in the middle; but in several domestic cats that I have opened, no notch was present in any of them; in this respect there appears to be some resemblance between the Spleens of the *Carnivora* and of man; these partial deviations of form being very frequent.

The arteries, veins, nerves, and absorbents, correspond, for the most part, with the size of the animal. In the dog, the splenic artery (as in the preceding classes), is a branch of the cœliac axis; it passes downwards and outwards to the under part of the Spleen, sending from 15 to 20 branches into its substance. In a dog, now before me, 17 branches can be traced into the Spleen; the same number of veins emanating from it and accompanying the arteries; and these veins, about an inch from the Spleen, are joined by the coronary veins of the stomach, which are very numerous, and serve to increase much the calibre of the vessel. The pancreatic veins next join the splenic which unites with the large venous trunk of the intestinal veins, to form the vena portæ. (See Plate 7, Arteries, Veins, &c. E.) The Spleen-pulp, the blood, and Malpighian bodies present nothing remarkable in this class.

The subjoined comprise the animals in the Table The relative weights

as in the other Tables have been added. The weights of the viscera are in grains, unless ozs. are named.

1. Grisly Bear. (*A. ferox, N. America*). Age, 3 yrs.; C. D. *Pneumonia;* weighed $86\frac{1}{4}$ lbs; S. 2,080 $\frac{1}{291}$; L. 31 ozs. $\frac{1}{44}$; K. 2,650 $\frac{1}{229}$; H. 24 ozs. $\frac{1}{57}$; Lgs. 36 ozs. $\frac{1}{38}$; A. C. 42 ft.

2. Black Bear. (*U. Americanus*). Died in a fit. B. 100 lbs.; S. 1,100 $\frac{1}{640}$; L. 24 ozs. $\frac{1}{66}$; P. 540 $\frac{1}{1337}$; K. 880 $\frac{1}{800}$; H. 9 ozs. $\frac{1}{177}$; Lgs. 24 ozs. $\frac{1}{66}$; A. C. 30 ft.

3. Malay Bear. (*U. Malayanus*). Young; B. about 6 lbs; S. 180 $\frac{1}{234}$; L. 2,200 $\frac{1}{19}$; K. 129 $\frac{1}{327}$; H. 660 $\frac{1}{64}$; Lgs. 880 $\frac{1}{48}$; A. C. 10 ft. 5 ins.

4. No. 2. 4 years old; B. about 40 lbs.; S. 1,510 $\frac{1}{186}$; L. 28 ozs, $\frac{1}{30}$; P. 180 $\frac{1}{1564}$; K. 655 $\frac{1}{429}$; H. 8 ozs. $\frac{1}{72}$; Lgs. 11 ozs., 215 grs. (the figure one in the eleven omitted in the Table); A. C. 22 ft. 4 ins.

5. *Coati Mondi.* (*S. America*). Spleen large and full of tubercles; lungs and liver sound; mesenteric glands enlarged; B. thin; weight *about* 5lbs; S. 720 $\frac{1}{48}$; L. not entered; K. 240 $\frac{1}{146}$; H. 220 $\frac{1}{160}$; Lgs. 460 $\frac{1}{76}$; A. C. 11 ft. 5 ins.

6. Badger. (*Ursus meles, Europe*). (Shot.) B. 12 lbs.; S. 1,320 $\frac{1}{64}$; L. 3,300 $\frac{1}{25}$; K. 660 $\frac{1}{128}$; H. 1,040 $\frac{1}{81}$; Lgs. 1,490 $\frac{1}{56}$; A. C. 17 ft. 6 ins.

7. Ratel. (*V. mellivora, Africa.*) Very fat; B. 12 lbs.; S. 600 $\frac{1}{140}$; L. 3,850 $\frac{1}{21}$; P. 112 $\frac{1}{754}$; K. 425 $\frac{1}{198}$; H. 664 $\frac{1}{127}$; Lgs. 1,980 $\frac{1}{42}$; A. C. 7 ft. 9 ins.

8. Taira. (*M. barbara, S. America*). Tubercles in liver and spleen, a few in the lungs; B. about 6 lbs.; S. 820 $\frac{1}{51}$; L. 3,300 $\frac{1}{12}$; P. 69 $\frac{1}{612}$; K. 250 $\frac{1}{168}$; H. 410 $\frac{1}{103}$; Lgs. 860 $\frac{1}{49}$; A. C. 8 ft. 6 ins.

9. Weasel. (*M. vulgaris, Europe*). (Shot.) B. 4 ozs.; S. 10 grs. $\frac{1}{176}$; L. 25 $\frac{1}{70}$; H. 25 $\frac{1}{70}$; A. C. 3 ft. 1 in.

10. Stoat. (*M. erminea, Europe*). (Shot.) B. 10 ozs. 60 grs.; S. 22 $\frac{1}{202}$; L. 82 $\frac{1}{54}$; K. 60 $\frac{1}{60}$; Lgs. 82 $\frac{1}{54}$.

11. Otter. (*M. lutra, Europe*). Injured foot; B. 6 lbs. $13\frac{1}{2}$ ozs.; S. 148 $\frac{1}{325}$; L. 2,675 $\frac{1}{18}$; P. 158 $\frac{1}{304}$; K. 220 $\frac{1}{219}$; H. 665 $\frac{1}{72}$; Lgs. 1,315 $\frac{1}{36}$; A. C. 14 ft. 1 in.—12. No. 2. B. about lbs; S. 450 $\frac{1}{93}$; L. 2,200 $\frac{1}{19}$; P. 115 $\frac{1}{367}$; K, 280 $\frac{1}{150}$; H. 840 $\frac{1}{50}$; Lgs. 1,400 $\frac{1}{30}$; 13. No. 3. B. about 8 lbs.; S. 452 $\frac{1}{124}$.

14. Long-eared Fox. (*Megalotis, Africa*). B. about 10 lbs.; S. 300 $\frac{1}{234}$; L. 1,980 $\frac{1}{35}$; P. 30 $\frac{1}{2346}$; K. 380 $\frac{1}{185}$; H. 445 $\frac{1}{158}$; Lgs. 885 $\frac{1}{79}$; A. C. 5 ft. 6 ins.

15. Common Fox. (*C. vulpes*). (Shot.) B. 9 lbs.; S. 380 $\frac{1}{166}$; L.

2,260 $\frac{1}{28}$; P. 140 $\frac{1}{452}$; K. 280 $\frac{1}{226}$; H. 940 $\frac{1}{67}$; Lgs. 1,180 $\frac{1}{53}$; A. C. 10 ft. 5 ins.—16. No. 2. B. 12 lbs.; S. 540 $\frac{1}{156}$.

17. Indian Wolf. (*C. lupus*). Young; B. about 3 lbs.; S. about 40 grs. $\frac{1}{528}$; L. 860 $\frac{1}{24}$; K. 165 $\frac{1}{128}$; H. 225 $\frac{1}{93}$; Lgs. 340 $\frac{1}{62}$; A. C. 6 ft. 1 in.—23. No. 2; B. 10 lbs.; S. 240 $\frac{1}{293}$.

18. Jackall. (*C. aureus, India*). Young: *Peritonitis.* Colon obstructed with hay; B. about $2\frac{1}{4}$ lbs.; S. 32. $\frac{1}{495}$; L. 885 $\frac{1}{17}$; K. 160 $\frac{1}{99}$; H. 288 $\frac{1}{69}$; Lgs. 360 $\frac{1}{44}$; A. C. 5 ft. 4 in.

19. Dog. (*C. familiaris*). Terrier; (violence.) B. $4\frac{1}{2}$ lbs.; S. 100 $\frac{1}{316}$; L. 1,980 $\frac{1}{16}$; P. 60 $\frac{1}{525}$; K. 185 $\frac{1}{171}$; H. 490 $\frac{1}{64}$; Lgs. 660 $\frac{1}{47}$; A. C. 7 ft. 4 ins.—20. No. 2. Poisoned. B. $5\frac{1}{2}$ lbs.; S. 90 $\frac{1}{430}$; L. 2,420 $\frac{1}{16}$; P. 85 $\frac{1}{455}$; K. 180 $\frac{1}{215}$; H. 480 $\frac{1}{80}$; Lgs. 880 $\frac{1}{44}$; A. C. 7 ft. —21. Charles 2nd's Spaniel. Very fat. Blood, oily; B. about 10 lbs.; S. 180 $\frac{1}{391}$.—22. Italian Greyhound; (violence.) B. $8\frac{1}{2}$ lbs.; S. 240 $\frac{1}{249}$.

23. Ichneumon. (*V. Ichneumon, Egypt*). *Peritonitis;* obstructed bowels; B. 16 ozs.; S. 15 $\frac{1}{496}$; L. 310 $\frac{1}{22}$; K. 35 $\frac{1}{146}$; H. 48 $\frac{1}{201}$; Lgs. 80 $\frac{1}{88}$; A. C. 4 ft. 1 in.

24. Civet-cat. (*V. civetta, Africa*). B. 28 ozs.; S. 30 $\frac{1}{410}$; L. 520 $\frac{1}{23}$; P. 17 $\frac{1}{724}$; K. 74 $\frac{1}{166}$; H. 89 $\frac{1}{138}$; Lgs. 133 $\frac{1}{92}$; A. C. 5 ft. 2 in.

26. Surikate. (*V. tetradactyla, Africa*). Tuberculated and fatty liver; Spleen large but not tuberculated. B. 11 ozs.; S. 35 $\frac{1}{138}$; K. 52 $\frac{1}{93}$; H. 115 $\frac{1}{42}$; Lgs. 140 $\frac{1}{34}$; A. C. 5 ft.

27. Lion. (*F. leo, Africa*). 5 years old; *Bronchitis;* lungs damaged by previous inflammation. B. *about* 224 lbs.; S. 5 ozs. 330 grs. $\frac{1}{625}$; L. 5 lbs. 8 ozs. $\frac{1}{40}$; K. 7 ozs. $\frac{1}{112}$; Lgs. 7 lbs. $\frac{1}{32}$; A. C. 24 ft.

28. Lion. No. 2. 5 years old; $3\frac{1}{2}$ years in England; false aneurism of the lung. The animal weighed in my presence 224 lbs.; Spleen about 6 ozs. (it has fat attached to it in the preparation.) S. about $\frac{1}{594}$; L. 108 ozs. $\frac{1}{33}$; P. 4 ozs. $\frac{1}{896}$; K. 8 ozs. $\frac{1}{448}$; H. 28 ozs. $\frac{1}{128}$; Lgs. 81 ozs. $\frac{1}{44}$.

29. Lioness. Convulsive fits; hay in the stomach; brain normal; all the viscera sound. Weighed in my presence 268 lbs.; S. about 9 ozs. $\frac{1}{611}$; L. 72 ozs. $\frac{1}{59}$; P. 2 ozs. 2,144; K. 6 ozs. 713; H. 16 ozs. $\frac{1}{268}$; Lgs. 42 ozs. $\frac{1}{102}$; A. C. 27 ft. 4 ins.

30. Tigress. (*F. tigris.*) *Bronchitis*; emphysematous lungs; B. about 212 lbs.; S. 6 ozs. 220 grs. $\frac{1}{521}$; L. 52 ozs. $\frac{1}{65}$; P. $4\frac{1}{2}$ ozs. $\frac{1}{753}$; K. 9 ozs. $\frac{1}{376}$; H. 14 ozs. $\frac{1}{242}$; Lgs. 34 ozs. $\frac{1}{99}$; A. C. not entered. (See other specimens below.)

31. Large Leopard. (*F. leopardus, India*). Recent pericarditis; old pneumonia and schirrhous tumour of the liver; B. about 200 lbs.; S.

9 ozs. 380 grs. $\frac{1}{324}$; L. 52 ozs. $\frac{1}{61}$; P. $3\frac{1}{2}$ ozs. $\frac{1}{914}$; K. $8\frac{1}{2}$ ozs. $\frac{1}{376}$; H. $21\frac{1}{2}$ ozs. $\frac{1}{148}$; Lgs. 68 ozs. $\frac{1}{47}$; A. C. 16 ft. 6 ins.

32. Lynx. (*F. lynx, Persia*). Very fat; viscera sound; B. 24 lbs.; S. about 120 grs. $\frac{1}{1408}$; L. 2,860 $\frac{1}{59}$; K. 440 $\frac{1}{381}$; H. 660 $\frac{1}{256}$; Lgs. 1,720 $\frac{1}{95}$; A. C. 9 ft. 4 ins.—33. Serval. (*F. serval, Africa*). B. about 10 lbs.; S. about 100 $\frac{1}{704}$; L. 1,960 $\frac{1}{35}$; P. 90 $\frac{1}{782}$; K. 510 $\frac{1}{138}$; H. 540 $\frac{1}{130}$; Lgs. 1,340 $\frac{1}{52}$; A. C. 8 ft. 2 ins.—34. Wild-cat. (*F. catus ferus, Europe*). (Shot.) B. 9 lbs.; S. 131 grs. $\frac{1}{483}$.—35. Domestic cat. (*F. domestica*). (Shot.) B. 7 lbs.; S. 70 $\frac{1}{704}$; L. 1,324 $\frac{1}{37}$; K. 185 $\frac{1}{266}$; H. 225 $\frac{1}{219}$; Lgs. 495 $\frac{1}{99}$; A. C. 6 ft. 6 ins.—36. Kitten; half-grown; killed accidentally by chloroform. B. 2 lbs.; S. 49 $\frac{1}{287}$; L. 600 $\frac{1}{23}$; P. 45 $\frac{1}{312}$; K. 90 $\frac{1}{156}$; H. 90 $\frac{1}{156}$; Lgs. 180 $\frac{1}{78}$; A. C. 5 ft. 9 ins.

Insectivora. 37. Hedgehog. (*E. Europæus*). B. 16 ozs.; S. 23 $\frac{1}{306}$; L. 480 $\frac{1}{14}$; K. 45 $\frac{1}{156}$; H. 48 $\frac{1}{146}$; Lgs. 62 $\frac{1}{113}$; A. C. 7 ft. 3 ins.

38. Shrew. (*Sorex araneus, Europe*). B. 305 grs.; S. 1 $\frac{1}{305}$; L. 14 $\frac{1}{21}$; K. $1\frac{3}{4}$ $\frac{1}{174}$; H. 2 $\frac{1}{152}$; Lgs. $1\frac{1}{2}$ $\frac{1}{203}$; A. C. 12 ins.

39. Mole. (*Talpa, Europæa*). B. $3\frac{1}{2}$ ozs.; S. 4 $\frac{1}{110}$; L. 49 $\frac{1}{31}$; H. 10 $\frac{1}{154}$; Lgs. 42 $\frac{1}{36}$; A. C. 5 ft. 9 in.—40. No. 2; B. 2 ozs. 310 grs.; S. 14 $\frac{1}{85}$; L. 46 $\frac{1}{25}$; K. 6 $\frac{1}{198}$; H. 8 $\frac{1}{148}$; A. C. 5 ft. 1 in.

Amphibia. 41. Seal. (*Phoca vitulina, Europe*). See page 25 for weight of viscera. The proportions to the body are S. $\frac{1}{299}$; L. $\frac{1}{70}$; P. about $\frac{1}{2035}$; K. $\frac{1}{925}$; H. 254; Lgs. $\frac{1}{149}$.

Young animals. Weasel, $\frac{1}{4}$ grown; B. 660 grs.; S. 2 $\frac{1}{330}$; L. 36 $\frac{1}{18}$; K. 5 $\frac{1}{132}$; Lgs. 6 $\frac{1}{110}$; A. C. 21 in.

¶ I have made many dissections of the Carnaria since the last table was formed, and several of them are very rare. The Cape Hunting Dog *(Lycaon pictus)*, I believe has never before been dissected in this country; and I have fully determined *(Proceedings of the Zoological Society*, 1855,*)* that it belongs to the Dogs, and not to the Hyænas, as supposed in Carpenter's "*Translation of Cuvier's Animal Kingdom*," *p.* 92.

Note. The Binturong, Tree Tiger, Polar Bear, and Walrus, are likewise animals but rarely dissected in this country. Of these I give the *proportions* of the *viscera* to the *body*, with the length of the Alimentary Canal; of the other animals of this class, the Spleen only.

43. Mole. No. 3. S. 145.—44. No. 4. S. 86.—45. Polar Bear *(Thalassarctus maritimus, Europe)*. B. about 3 cwt.; S. 281; L. 57; K. 537; H. 119; Lgs. 56; A. C. 29 ft. 2 in. 46. Binturong. *(Ictides, Sumatra)*. S. 392; L. 19; P. 542; K. 180; H. 115; Lgs. 36; A. C. 9 ft. 8 in.—47. Kinkajou. *(Cercoleptes caudivolvus, S. America)*. S. 344.—48. Badger. No. 2. S. 182. 7. Otter. No. 4. S. 144.—50. Blood Hound. S. 320.—51. Large Mastiff. B. 104 lbs.; S. 272.—52. Cape Hunting Dog. *(Lycaon pictus)*. B. $33\frac{1}{2}$ lbs. S. 280; L. 28; P. 599; K. 205; H. 72; Lgs. 21; A. C. 13 ft. 6 in. This animal, a bitch, recently died (July, 1855) at the Regent's Park Gardens; the dog, which I likewise dissected, died about ten days before. The viscera were about the same; but the body of the bitch only was weighed.—53.

Ichneumon. No. 2. S. 430.—54. No. 3. Banded Ichneumon. *(H. fasciatus, Africa).* S. 554.—55. Polecat. *(M. putorius, Europe).* S. 153.—56. Abyssinian Gennet. *(G. afra).* S. 193.—57. Cape Gennet. *(G. felina).* —58. Angora Cat. S. 483.—59. Wild Cat. *(Scotland).* S. 564 (not divided as in the other specimen).—60. Domestic Cat, 20 years of age. S. 675.—61. Old Lioness. B about 2 cwt.; S. 477.—62. Old Tigress. No. 2. B. about 1½ cwt.; S. 341.—63. No. 3. Tiger, aged 8 years; B. about 2 cwt.; S. 298.—64. No. 4. Tiger, aged 5 years. B. about 1½ cwt.; S. 304.—65. Tree Tiger. *(F. macrocelis, Sumatra).* B. 20½ lbs.; S. 451; L. 28; P. 775; K. 307; Lgs. 18; A. C 9 ft. 2 in.—66. Jaguar *(F. onca, S America).* B. about 1½ cwt.; S. 192; L. 18; K. 274; H. 192; Lgs. 30; A. C. 22 ft. 11½ in.—67. Caracal. *(E. caracal, Africa).* S. 670.—68. Lynx. (*Caracal Melanotis).* New species. B. 33 lbs.; S. 528; L 58; P. 1,500; K. 322; Lgs. 52; A. C. 10 ft. 3 ins.—69. Ocelot. *(F. pardalis, S. America).* S. 748. —70. Eira. *(S. America).* S. 894.—71. Leopard. No. 2. S. 224.—72. No. 3. Black Leopard (variety). S. 320.

73. Young Lion, at birth. B. 2 lbs. 9 oz.; S. 371; L. 29; P. 1,128; K. 100; H. 121; Lgs. 52.

74. Walrus.—I had an opportunity, at the College of Surgeons, of being present at the dissection of the viscera of a young Walrus (*Trichecus rosmarus*), that died at the Regent's Park Gardens, 1853. I weighed the organs with steelyards, and measured the alimentary canal; and took sketches of the abdominal and thoracic viscera The following is about the weight of the body and viscera:—B. 110 lbs.; Spleen and Pancreas not weighed, the former about 7 ozs. 1-293; the latter about 4 ozs. 1-1140; L. 72 ozs. 1-24; K. 9½ ozs. 1-185; H. 31 ozs. 1-56; Lgs. 78 ozs. 1-22; A. C. 76 ft. The Spleen was seated on the left side of the stomach; it was narrow, and measured 16 inches in length, (Plate 2, fig. 58); its colour, a light red, mottled by the attachments of the trabeculæ, which were very distinct; the artery and vein ran on the outside, as in the pig and other of the pachyderms. The vein leaves the Spleen about 4 inches from its upper end. The splenic veins not so large as in the seal; no valves in the splenic nor portal vein; the latter vessel, an inch in diameter, near the liver. (Professor Owen has described some parts of the anatomy of this animal in the *Proceedings of the Zoological Society*, 1853, p. 103).

Some of the above animals, in the last Table, (Nos. 19, 62, 63, 64, 66, and 67,) died of a peculiar blood-disease. The spleen of the Jaguar, in two places was infiltrated with thick purulent deposit. My description of the disease is reported in the Proceedings of the Medical Society of London.—*(Lancet* and *Medical Times*, March, 1854.)

Arteries and Veins.—In Plates 2, 3, 4, and 8 E., I have figured from nature, and my exact measurement,—1st, the splenic vein of a large Leopard. The chief branches in the Spleen are about 23; their mouths are of a valvular form; but when the vein is distended, the apertures would probably become more circular, and admit of regurgitation of the blood. The vessels, and their mode of entering the Spleen, are shown in the Lion, Leopard, Sun Bear, Otter, and Surikate. In the Lion, the principal branches from the artery are about 23; in the Leopard, about 18; in the Otter and Surikate, from 10 to 15. In Plate 8, the heart, aorta, and its abdominal branches in a Civet Cat, are exhibited, with the same parts in an Italian Greyhound, including the vena portæ and its tributaries. All the above had been injected with wax or size, before the sketches were taken.

The veins from the stomach to the splenic veins in the Carnaria vary in number from four to seven or eight, and the branches from the Spleen from 15 to 30. In the Polar Bear they are very numerous. In the Tree Tiger, (*F. macrocelis,*) the splenic veins leave the Spleen from its inner part

by 18 branches, these form two main trunks, about two inches in length, which unite into a single trunk, (1½ inch), the latter vessel receiving the pancreatic and mesenteric veins, to form the vena portæ. In the Otter, the veins from the stomach are so arranged that their blood under certain circumstances regurgitates into the spleen. I have in only one instance found valves in the splenic vein of a carnivorous animal. This was in the large Mastiff, (old),—No. 51. The stomach of this dog was of enormous size, (see Preparations 401 and 402); and, strange to say, there were several pairs of distinct semilunar valves in the splenic vein and its tributaries, (Plate IV.) It is possible that these valves did not exist at birth, and that they were gradually formed, in consequence of the unnatural condition of the animal. In several dogs I have examined, no valves were present, and I had concluded that they did not exist in carnivorous animals. The subject however demands further investigation, and it may be found hereafter that the band-like elevations in the coats of some veins may be gradually converted into valves. A valvular arrangement is common enough in this, as in other classes of animals; but, as I said before, I have only in this instance found distinct valves in a flesh-feeding animal. Before I quit this part of my subject, I may mention, that in many of the *carnaria* (the common cat, *e. g.*) the branches of the splenic artery are more numerous and convey a larger quantity of blood to the stomach than to the Spleen; a fact of great importance in this enquiry.

AVERAGES.

¶ In the first table (original) which includes 42 of the *Carnaria*, the Spleens of 38 of them average about 1-364 as compared with the weight of the body; the four *Insectivora*, averaging only 1-201. In the second table, since formed, the animals amount to 32, viz., two *Insectivora*, average 1-115; whilst the remaining 30, average 1-397. Selecting 6 healthy animals, (Nos. 11, 15, 24, 28, 31, 37,) from the original table, the proportional weight of the viscera to the body is about the under named;—S. 354; L. 29; P. 658; K 265; H. 116; Lgs. 64.

PLATES.

¶ The Spleens of the *Carnaria* are figured in Plate 2. The length is *first* given and then the breadth in inches, when lines are not named. Figure XXXI. Grisly Bear, 9½. 2.—XXXII. Black Bear, 7. 1½.—XXXIII. Sun Bear, 8½. 1¾—XXXIV. Polar Bear, 21. 2¾.—XXXV. Otter, 3¾. 1.—XXXVI. Weasel, 20 ls. 4 ls.—XXXVII. Stoat, 2¼ 6 ls.—XXXVIII. Ratel, 4½. 1¾.—XXXIX. Fox, 5¼. 1¼.—XL. Ichneumon, 2½. 5 ls.—XLI. Surikate, 2½. 7 ls.—XLII. Jackall, 2½. 8 ls.—XLIII. Young Wolf, 4. 9 ls.—XLIV. Terrier Dog, 4½. 10 ls.—XLV. Badger, 6. 1¾.—XLVI. Falkland Island Fox, 6½. 8 ls.—XLVII. Lion, 12. 2¾.—XLVIII. Tigress, 11. 2½.—XLIX. Large Leopard, 12. 3¼.—L. Lynx, 6. 10 ls.—LI. Civet Cat, 23 ls. 8 ls.—LII. Serval, 6. 11ls.—LIII. Long-eared Fox, 5¾. 1¼.—LIV. Wild Cat, 6. 1.—LV. Common Cat, 4½. 1.—LVI. Tree Tiger, 6. 1.—*Insectivora.* XCIV. Hedgehog, 22 ls. 4½ ls.—XCV. Mole, 14 ls. 3 ls.—XCVI. Shrew, 6 ls. 1½ ls. —*Amphibia.* LVII. Seal, 11½ 4¾.—LVIII. Walrus, (young,) 16 ins. in length.

MARSUPIATA.

In the Marsupiate animals, the Spleen in some, (the kangaroos) is bifurcated; the forked appendages being attached by folds of the peritoneum to the small intestines; whilst the larger and single

end, is united to a part of the great curvature of the stomach by a fold of peritoneum about an inch in length. The Spleen is unattached to the diaphragm, and alters its position according to the state of distension of the enormous stomach of the animal. The Spleen in all the kangaroos that I have dissected, (5) was very lax, thin, and flabby; the colour a bluish red. In the Phalanger and in Mauge's Dasyure (fruit and insect-feeders) the Spleen is of a somewhat triangular form, whilst in one species, (judging from the specimen—Plate 9 *Marsupiata,*) the Spleen is tripartite. As far as my dissections have gone, the bifurcated or three-lobed Spleen is only found in this class of animals, (*marsupial,*) but it is not universal among these.

The splenic vessels are seen in the Spleen of the large kangaroo, (Plate 2 E, *Marsupiata ;*) the artery, vein, and nerve accompany each other on the outer side of each lobe; the nerve and artery sending branches into the Spleen, the veins emerging at regular intervals from the surface of the organ. In the Dasyure (Plate 7, No. 1 E) the artery runs along the convex edge of the under surface of the Spleen, and sends in numerous branches; the Spleen was situated at the left end of the stomach, but in specimen No. 2, the lobes of the Spleen extended directly across the abdomen over the stomach to the right side. In the Phalangers and Opossums the Spleens are firmer than in the kangaroos.

The absorbent glands in the *Marsupiata* are very distinct, but I have not succeeded in tracing the lymphatic vessels from them. The microscopic drawings (in Plate 2 E) exhibit the structure of the organ in the kangaroo, also microscopic prep. 8. And the subjoined figure shows the Malpighian bodies and the Spleen pulp. (See Plate 3, fig. 10.)

Weight.—Taking the large kangaroo as a type of this class, the weight of the animal being 40 lbs., and that of the Spleen 2 ozs. 220 grs., and deducting the grains on account of the possible adherence of fat and cellular tissue, the weight of the Spleen as compared with the body is as 1 to 320. If the reader will compare the weights of the other ten Marsupial animals in the table, he will find that sometimes they differ materially from the foregoing; but as I have said before, it is difficult to draw a correct inference respecting animals in a state of confinement. This

kangaroo, however, appeared a few days before its death to be in perfect health.

Since the above was written, I have had an opportunity of injecting the body of a small kangaroo which weighed 6 lbs. The aorta and its branches with the vena cava will be seen at Plate 8, fig. 1, Arteries and Veins E.

The splenic artery is 3½ inches long, and gives off the left coronary branch of large size; it (the splenic) proceeds as in man from the cœliac axis, but the *right* coronary artery is the largest of the three, a circumstance readily explained by the enormous size of the stomach of this animal. The portal vein formed by the intestinal, the splenic, and pancreatic, terminates in the vena cava at its upper part, near the opening in the diaphragm.

The list of animals dissected in this table include 12 of the *Marsupiata*. The weights are in grains, except when *lbs.* and *ozs.* are named.

1. Great Kangaroo. *(Macropus major, Australia).* C. D. Bleeding from the bowels. B. 37 lbs.; S $\frac{1}{592}$; L. $\frac{1}{29}$; K. $\frac{1}{296}$; H. $\frac{1}{84}$; Lgs. $\frac{1}{49}$; A. C. 27 ft. 6 in. The weight of the viscera is given at page 26.—No. 2. *(M. melanops).* B. 40 lbs ; S. 2 ozs. 220 grs. $\frac{1}{299}$.

3. Macropus.—? Small species; very fat. B. 9½ lbs.; S. about 90 grs. $\frac{1}{743}$; L. 7 oz. $\frac{1}{21}$; K. 250 $\frac{1}{267}$; H. 460 $\frac{1}{145}$; Lgs. 890 $\frac{1}{75}$; A. C. 16 ft. 7½ in.

4. Kangaroo Rat. *(Hypsiprymnus, Australia).* Fatty liver; thin; B. 3½ lbs.; S. 8 $\frac{1}{308}$; L. 1,320 $\frac{1}{18}$; K. 158 $\frac{1}{255}$; H. 260 $\frac{1}{94}$; Lgs. 205 $\frac{1}{120}$; A C. 10 ft. 10 ins.

5. Rock Kangaroo. *(Pterogale penicillata).* B. 20 lbs.; S. 182 $\frac{1}{773}$.

6. *Phalanger vulpina, (Van Dieman's Land).* B. 5 lbs.; S. 180 $\frac{1}{195}$; L. 1,320 $\frac{1}{26}$; K. 140 $\frac{1}{251}$; H. 400 $\frac{1}{88}$; Lgs. 320 $\frac{1}{110}$; A. C. 14 ft. 4 in. 7—No. 2. Thin; B. 3½ lbs.; S. 35 $\frac{1}{704}$.

8. Opossum. *(D. Virginiana, S. America).* Young; B. 5 ozs. 280 grs.; S. 8 $\frac{1}{285}$; L. 112 $\frac{1}{20}$; K. 20 $\frac{1}{114}$; H. 11 $\frac{1}{207}$; Lgs. 19 $\frac{1}{120}$; A. C. 3 ft. 4 in.

9. Mauge's Dasyure. *(D. Maugii, New Holland).* Enlarged and tuberculated liver and spleen; B. 2 lbs.; S. 360 $\frac{1}{39}$; L. 1,040 $\frac{1}{13}$; K. 80 $\frac{1}{176}$; H. 24 $\frac{1}{586}$; Lgs. 140 $\frac{1}{100}$; A. C. 4 ft. 4 ins.

10. Dasyure. *(D. macrourus).* Young; thin; B. about 13 oz.; S. 50 $\frac{1}{114}$; L. 410 $\frac{1}{13}$; K. 47 $\frac{1}{121}$; H. 82 $\frac{1}{69}$; Lgs. 86 $\frac{1}{66}$; A. C. 3 ft. 6 in.

11. Small Kangaroo. *(Australia).* Species undetermined. B. about 6 lbs.; S. 180 $\frac{1}{234}$.

12. Tree Kangaroo. *(Dendrolagus inustus, New Guinea).* Tuberculated liver; B. 16 lbs.; S. 126 $\frac{1}{894}$; L. 9 oz. 380 grs. $\frac{1}{25}$; P. about 60 $\frac{1}{1877}$; H. 3½ ozs. $\frac{1}{73}$; A. C. 15 ft. 7 in. The weight of the body is taken from Professor Owen's paper. This, I believe, is the only specimen that has been dissected in this country, and I refer the reader to the Proceedings of the Zoological Society, 1854, p. 103, for an account of the anatomy, by Professor Owen, in which two mistakes occur. The liver was large and *tuberculated,* (not normal;) and the alimentary canal measured 15 ft. 7 in., not 13 ft. 7 in., as stated in Professor Owen's paper. I measured the parts preserved at the College; and nearly all the small intestines (the mesentery *uncut*), with the liver, lungs, spleen, and pancreas (instead of being thrown down the College well), were sent to my house, and I took the drawings of these parts in Plate 10 E.—*After Note.*

¶ I had permission to examine animals dying at the Zoological Gardens, and also to see those dissected at the College of Surgeons. This circumstance the reader may think unimportant, but I feel bound to mention it, for if (as I have explained to Professor Owen) I had been found inaccurate in this matter, the adjudicators might have distrusted the correctness of many of my statements.—*After note.*

¶ In addition to the above, I have dissected other members of this class, one of them never, I believe, dissected before. 13. The Tasmanian Wolf. (*Thylacinus, Van Dieman's Land.*) The body of this animal measured 2 ft. 9½ ins.; the alimentary canal, only 6 ft. 4 ins.; but to compensate for this shortness, a large extent of the mucous lining of the small intestines was thickly covered with villi, like those in the *rumen* of the rein deer. (See the Proceedings of the Zoological Society, 1855). Tho proportions of the viscera to the body are,—S. 382; L. 37; K. 382; H. 127; Lgs. 112; A. C. 6 ft. 4 ins.

This animal was very fat; the fat in the pelvis and abdomen weighed 2¾ lbs. The Spleen, lax and long (10½ ins.) with a lateral tongue-like process, as shown in Plate 2, fig. 69. It was seated on the left side of the stomach, embedded in hard fat; no valves were present in the splenic vein. 14.—Vulpine Phalanger. No. 3. B. 6 lbs.; S. about 704; P. 1,408; K. 249; H. 264.—15. Kangaroo Rat (*Hypsiprymnus, Australia*), new species, with a young one in her pouch, B. 2 lbs. 4 ozs.; S. 104; L. 27; K. 288; H. 125; Lgs. 99; A. C. 5 ft. 5 ins.

16. Young Rat.—Length of body, 24 lines, weight, 161 grs.; S. 124 4-5; L. 26 5-6; K. 107 1-3; H. 64 2-5; Lgs. 40 1-4: Brain, 17 8-9; A. C. 12 ins. I examined the body of this animal with great accuracy, and the contrast between the relative weight of its viscera and those of the mother, is very interesting. The cause of the death of the latter animal (as in all specimens where the cause of death is not named), was doubtful.

17. *Macropus major.* No. 2. *m.* B. 112 lbs.; S. 580; L 44; K. 512; H. 112; Lgs. 59; A. C. 47 ft. 6 ins. The tail of this animal weighed 9 lbs 8 ozs.

The last is the only marsupial animal in which I have seen valves in the splenic and other portal veins; but I had not examined tho others (except the Tasmanian wolf) with sufficient care to form a correct opinion. It is, however probable, that in the Kangaroos, all of which have large stomachs, that valves aro present. The valves, in the animal in question, are represented in Plate 4. I exhibited theso valves at the Physiological Society,

when the Spleen was in a recent state; as reported in the *Lancet* and *Medical Times*, 1854.

AVERAGES.

¶ In the first table, excluding Mauge's Dasyure, the Spleen of which was tuberculated, and bore the proportion of 1-39 to the body; the average is 1-463. In the table since formed, 1-375. In five specimens (Nos. 1, 6, 10, 13, 15), all in good condition, and of different genera, *about* the average proportion of the viscera to the body is,—S. 271; L. 26; K 267; H. 98; Lgs. 87. The pancreas was only weighed in one instance, and the comparative weight was 1-1408.

PLATES.

¶ The drawings of the Spleens of the *Marsupiata* are given in Plate 2, figures 60 to 74. The length and breadth in inches, when lines are not named. Fig. 60. *Macropus Major*, 10¾ 2¾.—61. *m. Melanops*, 11¼ 1¼; Tree Kangaroo, 7½ inches 8 lines.—63. Rock Kangaroo, 6¼ 8 ls.—64. Rat Kangaroo, 4½ ins. 7 ls.—65. Vulpine Phalanger, 5 1¼.—66. Mauge's Dasyure, 4½ 1½. Young Virginian Opossum, 11 ls. 4½ ls.—68. *Dasyurus Macrorus*, 3½ 8 ls.—69. Tasmanian Wolf, 10½ 1.—70. Perameles, 3½ 5.—71. Wombat, *(Phascalomys)*, 2½ ins. 4½ ls.—72. *Dasyurus Ursinus*, 2 ins. 10 ls 1 in. (The last three are from the College Collection, Plate 4 E.)—74. Rat Kangaroo, 11 ls. 1½ ls.

RODENTIA.

The Spleens of the Rodents bear a great resemblance in both structure and colour; and the form, (as will be seen in Plates 1, 2, 3 E, *Rodentia*,) is very similar in the rats, mice, squirrels, hares, and rabbits. The Spleens of the moles, shrews, and hedge-hogs, (classed according to Cuvier with the *Carnaria*,) also greatly resemble these. The beaver has a thicker Spleen, and that of the agouti is more tapering at its free extremity than any of the others. (Plates 1 and 2 E.) The long-tailed porcupine has a square, bluish Spleen, whilst that of the jerboa, bears more resemblance to the rat, except that its surface is less irregular.

Situation—On the left side of the stomach, to which it is united by a band of mesentery, varying in length in the different animals, the Spleen altering its position according to the state of distension of the stomach. Thus in one agouti I dissected, the Spleen was seated upon the stomach; whilst in the other, (Plate 2, Fig. E,) it embraced the upper part of the left kidney. In the hare it is loosely united to the left side of the stomach, and seated between this organ and the kidney; the gastro-splenic omentum being from one inch to one and a half-inch long. In beavers, porcupines, rats, mice, and rabbits, the position is much the same, also in the

shrews, moles, and hedge-hogs, which in many respects resemble the *Rodentia* more than the *Carnaria.*

Structure.—The capsule is very thin, and in some of the rodents, the beaver and agouti especially, the divisions formed by the trabecular tissue are very distinct. The Spleen-pulp, as drawings Plates 1 and 3 E shew, is composed of clear, thin, irregular shaped cells, generally without a nucleus. The *Malpighian corpuscles* are very distinct in the beaver, but in the agouti more so than in any animal of this class that I have examined. Preparation 10 shews these bodies, and also microscopic Preparation 39, represented in Plate 3 of this Treatise. In this Table the weight of the viscera is in grains when not otherwise stated.

1. Flying Squirrel. (*Sciurus volucella, N. America*). *Pneumonia.* B. 2 ozs.; S. 9 $\frac{1}{97}$; L. 40 $\frac{1}{22}$; K. 6 $\frac{1}{146}$; H. 6 $\frac{1}{146}$; Lgs. 10 $\frac{1}{88}$; A. C. 2 ft. 9 ins.

2. Grey Squirrel. (*S. cinereus, N America*). B. 10 ozs. 20 grs.; S. 30 $\frac{1}{147}$; L. 180 $\frac{1}{24}$; K. 19 $\frac{1}{232}$; H. 40 $\frac{1}{110}$; Lgs. 48 $\frac{1}{92}$; A. C. 5 ft. 11 ins.

3. Common Squirrel. (*S. vulgaris*). (Shot.) B. 5 ozs. 40 grs.; S. 3 $\frac{1}{743}$; L. 85 $\frac{1}{26}$; K. 12 $\frac{1}{186}$; H. 27 $\frac{1}{82}$; Lgs. 38 $\frac{1}{58}$; A. C. 5 ft. 9 ins.

4. Dormouse. (*M. avellanareus, Europe*). B. 400 grs.; S. $\frac{1}{4}$ $\frac{1}{600}$; L. $7\frac{1}{2}$ $\frac{1}{53}$; K. 1 $\frac{1}{400}$; H. $1\frac{3}{4}$ $\frac{1}{228}$; Lgs. $1\frac{1}{2}$ $\frac{1}{266}$; A. C. 20 ins.

5. Common Rat. (*M. decumanus, Europe*). No. 1. B. $13\frac{3}{4}$ ozs.; S. 33 $\frac{1}{210}$; L. 262 $\frac{1}{26}$; K. 28 $\frac{1}{248}$; H. 39 $\frac{1}{178}$; Lgs. 80 $\frac{1}{86}$; A. C. 6 ft. 6 ins.—2. B. 13 ozs.; S. 93; hypertrophied, $\frac{1}{61}$; L. 340 $\frac{1}{16}$.—3. B. 12 ozs.; S. 23 $\frac{1}{229}$. In the seven following, all weighing about 12 ozs., the proportion of the Spleen to the body was 160, 195, 229, 264, 251, 352, 211. These 10 rats, about the same size and weight, were all examined, and their Spleens weighed directly after death. In No. 6, the Spleen and Liver were both enlarged, but not apparently diseased; neither sex nor pregnancy appeared to make any difference as regarded the weight of the Spleen. All the Spleens were of a dark red colour. In the rat with the smallest Spleen, the stomach was very full. The above were selected from a great number. In the four following, the ages are judged of by the size and appearance of the animal. 15 $\frac{1}{3}$ grown. B. 3 ozs. 240 grs.; S. 6 $\frac{1}{260}$.—16. Fourteen days old. B. 460 grs.; S. 2 $\frac{1}{230}$; —17. Six days. B. 254 grs.; S. about $\frac{2}{3}$ $\frac{1}{338}$.—18. Four days. B. 200; S. 1 $\frac{1}{200}$.

19. Water Rat. (*Arvicola amphibia, Europe*). B. 7 ozs.; S. 3 $\frac{1}{106}$; L. 123 $\frac{1}{25}$; K. 14 $\frac{1}{220}$; H. 23 $\frac{1}{133}$; Lgs. 13 $\frac{1}{286}$; A. C. 4 ft. 4 ins.

20. African Rat. (*Aulacodus*). Thin. B. 1 oz. 261 grs.; S. 2 $\frac{1}{350}$; L. 12 $\frac{1}{38}$; H. 5 $\frac{1}{140}$; Lgs. 5 $\frac{1}{140}$; A. C. 13 ins.—21. No. 2. B. about $2\frac{1}{2}$ ozs.; S. 3 $\frac{1}{500}$; L. 40 $\frac{1}{27}$; H. 8 $\frac{1}{137}$; A. C. 18 ins.—22. Egyptian Rat. Thin. B. about 2 ozs.; S. 3 $\frac{1}{293}$.

23. Field Mouse. *(M. sylvaticus, Europe)*. Pregnant. B. 1 oz. 120 grs.; S. 2 $\frac{1}{280}$; L. 30 $\frac{1}{18}$; K. 3 $\frac{1}{186}$; Lgs. $3\frac{1}{2}$ $\frac{1}{160}$; A. C. 31 ins.—24. No. 2. B. 10 ozs. 40 grs.; S. $2\frac{1}{2}$ $\frac{1}{192}$; L. 27 $\frac{1}{17}$; K. 4 $\frac{1}{120}$; H. 3 $\frac{1}{166}$; Lgs. 5 $\frac{1}{96}$; A. C. 18 ins.

25. Harvest Mouse. *(M. messorius)*. B. 121; S. 1 $\frac{1}{121}$; L. 9 $\frac{1}{14}$; K. $2\frac{1}{2}$ $\frac{1}{48}$; H. 2 $\frac{1}{60}$; Lgs. 4 $\frac{1}{30}$; A. C. 10 ins.

26. Common Mouse. *(M. musculus)*. B. 225; S. 1 $\frac{1}{225}$; L. 15 $\frac{1}{15}$; K. 2 $\frac{1}{112}$; H. 2 $\frac{1}{112}$; Lgs. $2\frac{1}{2}$ $\frac{1}{90}$; A. C. 24 ins.

27. Musquash. *(Castor Zibeticus, N. America)*. Red hepatization of lungs and tubercles. B. $14\frac{1}{2}$ ozs.; S. 12 $\frac{1}{531}$; L. 200 $\frac{1}{31}$; P. 6 $\frac{1}{1063}$; K. 27 $\frac{1}{236}$; H. 20 $\frac{1}{319}$; Lgs, 115 $\frac{1}{55}$; A. C. 5 ft. 2 ins.

28. Hare. *(L. timidus, Europe)*. B. 6 lbs. 4 ozs.; S. 61 $\frac{1}{721}$; L. 885 $\frac{1}{49}$; P. 42 $\frac{1}{1047}$; H. 445 $\frac{1}{98}$; Lgs. 440 $\frac{1}{100}$; A. C. 12 ft. 4 ins. —29. No. 2. B. 5 lbs. 12 ozs.; S. 18 $\frac{1}{2248}$; L. 885 $\frac{1}{45}$; Lgs. 380 $\frac{1}{106}$; A. C. 13 ft. 11 ins.

30. Rabbit. *(L. cuniculus, Europe)*. B. $2\frac{1}{2}$ lbs.; S. 7 $\frac{1}{2514}$; L. 882 $\frac{1}{19}$; K. 94 $\frac{1}{187}$; H. 70 $\frac{1}{251}$; Lgs. 155 $\frac{1}{114}$; A. C. 15 ft.—31. No. 2. B. $2\frac{1}{2}$ lbs.; S. 8 $\frac{1}{2200}$.

32. Fœtal Rabbit, (wild,) "full time." B. 460; S. $\frac{1}{2}$ gr. $\frac{1}{920}$; L. 30 $\frac{1}{15}$; K. $\frac{1}{230}$; H. $2\frac{1}{2}$ $\frac{1}{184}$; Lgs. 13 $\frac{1}{35}$; A. C. 25 ins.

33. Long-tailed Porcupine. *(H. prehensilis, S. America)*. B. about $4\frac{1}{2}$ lbs.; S. *about* 120 $\frac{1}{264}$; L. 1280 $\frac{1}{24}$; K 222 $\frac{1}{142}$; H. 186 $\frac{1}{170}$; Lgs. 326 $\frac{1}{99}$; A. C. 7 ft. 1 in.

34. Agouti. *(Dasyprocta Agouti, S. America)*. *Pneumonia*. B. 6 lbs.; S. 165 $\frac{1}{236}$; L. 1760 $\frac{1}{24}$; K. 180 $\frac{1}{234}$; H. 270 $\frac{1}{156}$; Lgs. 440 $\frac{1}{96}$; A. C. 23 ft. 6 ins.—35. No. 2. Pregnant. B. about 10 lbs.; S. 90 $\frac{1}{782}$; L. 320 $\frac{1}{53}$; K. 183 $\frac{1}{384}$; H. 370 $\frac{1}{190}$; Lgs. 580 $\frac{1}{121}$; A. C. 24 ft. 8 ins.

36. Jerboa. (*Dippus Sagitta, Africa*). B. about 4 ozs. (very fat); S. 12 $\frac{1}{146}$; L. 71 $\frac{1}{24}$; K. 11 $\frac{1}{160}$; H. 20 $\frac{1}{88}$; Lgs. 40 $\frac{1}{44}$; A. C. 3 ft. 2 ins.

37. Beaver. (*Castor Fiber, N. America*). B. about 12 lbs.; S. about 200 $\frac{1}{442}$.—38. Hare. No. 3. B. 7 lbs.; S. 25 $\frac{1}{1971}$; L. 1650 $\frac{1}{29}$;—39. No. 4. B. 7 lbs. 2 ozs.; S. 15 $\frac{1}{3344}$; L. 1,760 $\frac{1}{28}$.—40. No. 5. B. 8 lbs.; S. 51 $\frac{1}{1104}$; L. 1,818 $\frac{1}{30}$.

¶ I have some important additions to make to this table. The relative weights of the viscera to the body are only given.—41. *Capybara Cavia Cabybara, S. America*. Malignant disease of kidney. (See *Proceedings of*

the London Pathological Society, 1854, p. 347). B. 64 lbs.; S. 804; L. 36; K. 204, (the sound one); P. 1,787; A. C. 40¼ ft.

42. Canadian Porcupine. (*H. dorsata*). Distended stomach from over eating. B. 16¼ lbs.; S. 1,276; L. 23; K. 343; H. 244; Lgs. 196; A. C. 28 ft. 3 ins.

43. Beaver. No. 2. Young. B. 5 lbs; spleen and liver enlarged and tuberculated; S. 375 1-93; L. 7 ozs. 1-11.—44. Agouti. No. 3. B. 4 lbs.; S. (tuberculated) 380 1-76.—45. Marmot (*Arctomys Alpinus, Europe*). B. 3 lbs.; S. 37 1-570; In a second specimen, B. 1 lb. 13 ozs.; S. 196. In a third, B. *about* 3 lbs.; S. 154.

45. Grey Squirrel. No. 2. S. 968.—46. S——? (*West Indies.*) S. 1005.

47. *Sciurus maximus* (*India.*) B. 4 lbs. 3 ozs.; S. 1,179; L. 35; K. 393; H. 195; Lgs. 42; A. C. 15 ft 4½ ins. This beautiful animal, which I recently dissected, was in excellent condition; the cause of its death, doubtful.

48. African Rat. (*M. Alexandrinus.*) Very fat. S. 825.—40. Barbary Mouse. (*M. Barbarus.*) S. 1-220.—Long tailed Field Mouse. (*S. sylvaticus.*) S. 256.—51. Eight Specimens of the Common Mouse. S. 170, 204, 178, 244, 228, 216, 255, 254.—52. Two Hares. S. 2,696, 2,223.—Four Leverets, nearly full grown, examined in July. S. (956, 2,420, 983, 1,362,)—52. Six full grown wild Rabbits. S. 1,732, 1,760, 1,686, 1,211, 1,732, 2,310.—54. Nine full grown Water Rats. S. 1,052, 426. 298, 748, 586, 852, 941, 440, 1,048. In the last L. 1-29. In a young Water Rat, weighing 653 grs., the proportion of the Spleen to the body was 326; of the Liver, 29.

AVERAGES.

¶ The relative weight of the Spleens of the Rodents differ so much that it is useless to give the general average, but I select some well known animals of this country, of which I have examined many, for the purpose of comparison. The numbers are given above.—Hares and Leverets, 11; S. 1-1820, average.—Wild Rabbits, 8; S. 1-1,893, average.—Common Rats, 10; S. 1-229, average.—Common Mice, 9; S. 1-218, average.—Water Rats, 9; S. 1-710.

The great difference between the size of the Spleens of the quick running animals and those of slower pace will be at once apparent to the reader, and the difference between the water Rat and the land Rat is especially important; the former animal, with a much smaller Spleen, having a stomach considerably larger than the land Rat.

I have not detected valves in the portal veins of the Rodents, although I examined the *Capybara* (the largest of them) with great care, but the matter requires further attention.

PLATES.

¶ The spleens of the Rodents are seen in Plate 2, figs. 79 to 93. The length and breadth of both are in lines; *always* 12 to the inch. Fig. 76., Flying Squirrel, 13.2½.—77. Common Squirrel, 13.2½.—Common Rat, 24.5.—79. Water Rat, 12.3½.—80. African Rat (*Aulacodus*), 7.2¼.—81. Marmot, 36.7.—82. Common Mouse, 6.1½.—83. Field Mouse (long-tailed) 9.2,—84. 12.2½.—85. Jerboa, 11.2.—86. Beaver, 48.6½.—87. Longtailed Porcupine, 26.11.—88. Indian Porcupine, 20.8.—89. Canadian Porcupine, 30.8—90. Hare, 90.4½ —91. Rabbit, 21.3½.—92. Cabylara, 52.24.—93. Agouti, 36.8.

EDENTATA.

In Plates 2 and 11 E. I have figured the spleens of several of the animals of this class, the most remarkable of which is the (*Orycteropus*)

Ground Hog of the Cape (Plate 2, fig. 98 A.); an animal that feeds chiefly on ants. These specimens were all in spirits in the College store-room. I weighed the bodies with steelyards, and guessed at the weight of the spleens.—1. *Orycteropus.* Young; B. $2\frac{1}{4}$ lbs.; S. about 70 grs. $\frac{1}{220}$.—2. No. 2. This spleen measures $7\frac{1}{2}$ inches in length, and about $1\frac{1}{2}$ in breadth. The splenic artery, also figured, is $4\frac{1}{4}$ inches long, and its two lateral branches to the spleen, 3 inches each. The weight of the body is not given, but from the known size of the animal, the relative weight of the spleen, judging from this specimen, must be greater than in any of the *Edentata.*—3. *Bradypus Tridactylus. (*Ai, or Common Sloth, *S. America;)* two specimens,—one young; the body weighing about 16 ozs.; the spleen, 10 grs. about $\frac{1}{704}$. The other specimen is a fœtus; the spleen in both, thin, long, and somewhat triangular.—4. A young *Bradypus Didactylus* The spleen more like the *Orycteropus*; body not weighed.—5. The spleen of the *Ornithorynchus,* figured in Plate 11 E., and Plate 2, fig. 73, is six inches long, and about six lines in width; but it is *very* lax and thin. As stated under the sketch, the body which I weighed with steelyards was 6 lbs.; the spleen, not weighed, about 90 grs.; making the relative weight, if this estimate be correct, about $\frac{1}{469}$. The Spleen bears some resemblance to those of the *Perameles, Hypsiprymnus,* and *Hydromys* figured in the same plate; but it is thinner and longer than these.

¶ As I have stated before, the *Loris,* or *Lemur tardigrada,* was erroneously put with this class; its sloth-like appearance and slow movements, without looking at the teeth, inducing me, in the hurry of arrangement, to place it with the Ai (*Bradypus tridactylus*), an animal of very similar habits. As regards the teeth, it is as much a toothless animal as the Armadillo, which frequently has 40 teeth.

I had an opportunity, at the College of Surgeons, of seeing the viscera *in situ* of the large Ant-eater (*Myrmecophaga-jubata, S. America*) which died recently (July, 1854), at the Regent's Park Gardens. The spleen, 12 inches in length (represented at Plate 2, fig. 97), was seated on the left side of the stomach; the splenic vein large, and the *vasa brevia* numerous. Professor Owen has given a description of the anatomy of this animal in the *Proceedings of the Zoological Society*, 1854, (p. 155); and taking the weights of some of the viscera, as there stated, the proportion to the body is about as under,—S. 2 ozs. 6 drachms 1-352; L. 28 ozs. 1-35; P. 2 ozs. 1-496; A. C. 34 ft.; weight of body, 62 lbs. This is the only animal described in this Treatise, the viscera of which were not weighed or examined by myself.

I have also had an opportunity of dissecting, of late, two Armadillos, the six-banded and the nine-banded, both in good condition; the subjoined is the relative weight of the viscera to the body. *Dasypus sexcinctus, (S. America;)* B. $7\frac{1}{2}$ lbs.; S. 440; L. 36; P. 981; K. 268; H. 179; Lgs. 176; A. C. 12 ft. 8 ins.

Dasypus Peba; B. 7 lbs.; S. about 1-246; Brain 1-240; the other viscera, about the same as the last. The spleen is closely attached to the left side of the stomach. The splenic artery is 3 inches in length, and arises from the cœliac axis, as in man; it is rather largor than the hepatic, and smaller than the coronary; it runs along the pancreas, and, on roaching tho spleen,

it divides into two principal branches, which pass along the centre of the organ, and send branches to the interior; it gives off also, before its division, several branches to the pancreas, and many to the stomach. The veins follow the course of the arteries, and the *vena portæ* is formed in the usual manner. In the last specimen, I counted eight veins passing from the stomach to the splenic vein; I *think* no valves were present in the splenic vein; the splenic nerves very small.—Average weight of the Spleen to the body of the last four specimens of *Edentata*, 1-376.

Plate 2, fig. 97.—Large Anteater, about 12 ins. 18 lines.—98. Armadillo, (six-banded) 4 ins. 11 ls.—98A. *Orycteropus*, 7½ ins. 1½ in.—*Ornithorhynchus Paradoxus*, 6 ins. 6 ls.

PACHYDERMATA.

The animals of this class present some peculiarities which are worthy of notice. The Spleen is long, lax, and tapering at one extremity. In the Pig it is so elastic that it may be tied into two or three knots. The trabecular substance is very distinct, and the Malpighian bodies large. The Splenic Artery of the Horse unlike that of the ruminants, runs on the outside of the Spleen, and sends numerous branches into its substance; the nerves are very large, and this applies to nearly all the animals of this class. The nerves of the Horse are larger than I have seen them in any other animal. (See Prep. 72). The nerve-tubes when the sheath is removed, are very distinct; like the arteries, the branches of the main trunk are very small. There is nothing peculiar about the structure of the nerves in the *Pachydermata*, and I am unable to discover the distinction alluded to by Kölliker, between the nerves of the ruminants and of these animals; the structure of the Spleen of the Zebra, and of the Ass, is so similar to that of the Horse, that scarcely any difference is perceptible. In the Pig and Peccary the nerves are smaller in proportion than in the above-mentioned animals. The Elephant and Rhinoceros I have not had an opportunity of examining. In the careful examination of the splenic veins of twelve horses, I find the following result as regards the number of valves:—

1. Two valves, 2½ inches apart, crescent shaped.—2. Two valves, three inches apart.—3. Two valves and two folds of the lining membrane.—4. One valve close to the mouth of the vein, and two, four inches beyond.—5. (Three pairs), two at the mouth of the vein; two, six inches below.—6. Valve at the mouth of a large vein which enters the main trunk, and two valves three inches below.—7. Valves at the mouths of all the large veins, and

two pairs in the main trunk.—8. Valves at all the large openings, and two pairs six inches below the entrance.—9. No valve in the main trunk, but one in a large branch.—10. Two valves near the mouth of the vein, and two three inches below.—11. One valve near the mouth of the vein, and two, three inches below.—12. Three pairs of valves, and one pair at the mouths of all the lateral veins, besides those before described.

In addition to these valves, there are two near the mouths of each of the lateral veins, which enter into the main trunk, and one at the large vein running along the upper part of the Spleen. See Preparation 15, which shews these valves in the lateral veins. In the Zebra, I omitted to examine the splenic vein until the spleen had been some time in solution, when I could only see the remains of the upper valves; there is, I think, but little doubt that they exist in all the *Pachydermata.*

The absorbent glands in the Horse are larger than in any other animal I have dissected; they are oblong in shape, and vary in length from half an inch to an inch and a half; in number, from six to twelve; they follow the course of the artery, and their vessels may readily be seen by the naked eye when held up before a strong light: they pass transversely from the main trunk to the glands outside the Spleen, from which they are continued to the thoracic duct; the branches connected with each gland vary in number from three to seven. I have succeeded only once in injecting them with quicksilver. (Prep. 191.) In the Tapir, the glands, in size, are nearly equal to those of the Horse, and they are of the same shape. The Spleen pulp and Malpighian bodies are seen in Preparations 16, 72, 158, and in several of the drawings. (See also Plate 3).

This Table includes the following animals, besides 112 horses mentioned below; the weights are all in ozs., except when lbs. or grains are mentioned.

1. Tapir. *(T. Americanus).* Perforation of stomach from simple ulceration, aperture small and round. *Peritonitis.* B. about 3 cwt.; S. 29 $\frac{1}{185}$; L. 116 $\frac{1}{46}$; K. 13 $\frac{1}{413}$; H. 44 $\frac{1}{122}$; Lgs. 64 $\frac{1}{84}$; A. C. 62 ft.

2. Peccary. *(Dicotyles Torquatus, S. America).* *Pneumonia.* B. 12 lbs.; S. 340 grs. $\frac{1}{248}$; L. 8 ozs. $\frac{1}{24}$; P. 120 grs. $\frac{1}{704}$; K. 345 grs. $\frac{1}{244}$; H. 869 grs. $\frac{1}{97}$; Lgs. 4 ozs. $\frac{1}{47}$; A. C. 31 ft.

3. Hog. *(Sus scrofa, Europe)*. B. 11 stone 12 lbs., (always 14 lbs. to the stone); S. 4 ozs. $\frac{1}{664}$.—No. 2. B. 12 stone; S. $3\frac{1}{2}$ ozs. $\frac{1}{768}$ —No. 3. B. 9 stone; S. 4 ozs. $\frac{1}{504}$.—No. 4. B. 31 stone, very fat; S. $5\frac{1}{2}$ ozs. $\frac{1}{1262}$.—No. 5. B. 31 stone, very fat; S. 7 ozs. $\frac{1}{1120}$.—No. 6. Aged one day. B. about 3 lbs.; S. 65 grs. $\frac{1}{324}$.—No. 7. Aged $\frac{1}{2}$ day. B. about 3 lbs.; S. 60 $\frac{1}{352}$.

10. Zebra. *(Equus Zebra, Africa)*. Ran against the palings of its enclosure, and broke its neck. The weight of the viscera is given at page 26. The proportions to the body are (*about*) S. $\frac{1}{768}$; L. $\frac{1}{83}$; H. $\frac{1}{336}$; Lgs. $\frac{1}{268}$; A. C. 67 ft. The liver of this animal contained several large acephalocysts. The liver with these cysts (the sketch taken by measurement), is represented at Plate 6, *Pachydermata* E, and under the drawing is the following description of them: they were full of clear whitish fluid, and the sides of the cysts appeared to be covered with *echynococci*, but I had not time to examine them with the microscope. One of the cysts contained about 8 ozs. of fluid; two of them were full of hydatiginous cysts (hydatid-like,) the greater number of these being empty. The Spleen and other viscera were free from these cysts. The colon and cœcum of this animal weighed about 224 lbs.

11. Dray Horse. *(Equus caballus)*. Spontaneous rupture of the liver. B. about 18 cwts.; S. 4 lbs. 6 ozs. $\frac{1}{460}$; L 58 lbs. $\frac{1}{34}$; K. 3 lbs. $\frac{1}{672}$; H. 12 lbs. $\frac{1}{168}$; Lgs. 25 lbs. $\frac{1}{80}$; A. C. 108 ft.; small intestines, 82; large, 26. The colon and cœcum of this horse would probably have held 18 or 20 gallons of fluid. Mr. C. Braby, the intelligent Veterinary Surgeon to Barclay's establishment, assisted me at this examination. The blood of this horse contained hippuric acid (?)crystals readily dissolved by *Liquor Potassæ*.

11. Blood Mare, (old). B. about 10 cwt.; S. 2 lbs. 6 ozs. $\frac{1}{471}$; L. $11\frac{1}{2}$ lbs. $\frac{1}{97}$; H. $8\frac{1}{2}$ lbs. $\frac{1}{131}$; Lgs. 8 lbs. $\frac{1}{140}$.

12. Fœtal Colt, 9th month. B. about 50 lbs.; Spleen about $1\frac{1}{4}$ oz. $\frac{1}{640}$.—No. 2. 8th month of utero-gestation. B. about 42 lbs.; S. 1 oz. 110 grs. $\frac{1}{537}$; the small intestines of the last-named contained $\frac{3}{4}$ of a pint of clear yellow serum; the large, about one pound of brown matter, like treacle.

The Spleens of the following horses have all been weighed and examined by the author; the knacker being present to describe the weight, condition, breed, and disease of the horse. The animals were not weighed, the man, however, could guess the weight with tolerable accuracy.

¶ As I avoid the tabular form in this and the other tables, for reasons

before stated (p. 50), the reader will infer that, when the state of the Spleen is not mentioned, that it was in a normal condition. Generally, the cart horses were large; the cab horses of various sizes, and in bad condition; the coach horses larger, and better fed; but in many of the lean horses, the Spleen was relatively greater than in those well fed. I did not see any of these animals until after death. The weight of the Spleen is in ounces.

In the following 112, the weight of the body was noted in 60, in the remainder not.—No. 5. Coach horse, 14 cwt.; S. dense, 158 ozs.—8. Cab, 10 cwt.; S. 24.—9. Cab, 11 cwt.; S. dense, 176.—12. Cob, 9 cwt.; S. 18.—25. Coach, 15 cwt.; S. 27. (Glanders, see Plate E.).—26. Cart, very poor, 12 cwt.; S. very dense, 200.—27. Cart, 14 cwt.; S. dense, 192.—28. Coach, poor, 11 cwt.; S. 76.—29. Cob, 9 cwt.; S. 27.—30. Cob, 8 cwt.; S. 25.—37. Coach; broken leg; in good condition, 12 cwt.; S. 40.—38. Coach, 13 cwt.; S. 56.—40. Cab, 9 cwt.; S. 40. —41. Cab, 12 cwt.; S. dense, 107.—42. Cob, 13 cwt.; S. 30.—61. Pony, 4 cwt.; S. 10.—62. Cart, 11 cwt.; S. 33.—63. Coach, 11 cwt; S. 40; ruptured several years before, (see Plate E).—64. Cart, 10 cwt.; S. 22.—65. Cart, very poor, 4 cwt.; S. 56.—66. Cart, 11 cwt.; S. rather dense, 56.—82. Cart, 9 cwt.; S. 44.—83. Coach, poor, 7½ cwt.; S. 42.—84. Cart, poor, 6 cwt.; S. 25.—85. Cart, very poor, 3 cwt.; S. 48.—86. Cab, 7 cwt.; S. 37.—87. Cart, very fat, 12 cwt.; S. 91. The Spleen very dense, it cut like boiled beef, and the *trabeculæ* were very distinct.—88. Pony, 2 cwt.; S. 18 ozs..—89. Cart, poor, 6 cwt.; S. 26.—90. Cart, poor, 7 cwt.; S. 32.—91. Blood mare, very fat, 8 cwt.; died from over-exertion; S. 45, normal.—92. Cart. 10 cwt.; S. 144.—93. Cart, 14 cwt.; S. 112, lungs diseased.—94. Coach, 3½ cwt.; S. 56. —95. Cab, 9 cwt.; S. 56.—96. Coach, 10 cwt.; S. 56.—97. Coach, 10 cwt.; S. 44.—98. Coach, 9 cwt.; S. 43.—99. Pony, 6 cwt.; S. 26. —100. Cart, poor, 12 cwt.; S. 58.—101. Cart, 16 cwt.; S. 40.—102. Cart, poor, 10 cwt.; S. 47.—103. Coach, 12 cwt.; S. 52.—104. Cart, 10 cwt.; S. 72.—105. Cab, 8 cwt.; S. 36.—106. Cart, poor, 16 cwt.; S. 56.—107. Cab, 9 cwt.; S. 43.

In the undermentioned, the description of horse was named, but the supposed weight was not noted. 1. Cart; S. 88.—2. Cart; S. 66.—3. Pony; S. 28.—4. Cart; S. 46.—6. Coach; S. 43.—7. Coach; S. 43.—10. Cart, poor; S. 64.—11. Cart, poor; S. 88.—13. Cart; S. 188; dense and bloody. This horse knocked on the head; not bled.—14. Cob; S 24.—15. Cart; S. 60.—16. Cab; S. 44.—17. Cob; S. 24.—18. Cart; S. 32.—19. Cart; S. 25.—20. Cab; S. dense; 208. —21. Cab; S. 49.—22. Cab; S 28.—23. Cart, poor; S. 60.—24. Coach, fat; S. 44.—32. Cob; S. 20.—33. Cob; S. 48.—34. Thorough bred; S. dense; 99.—35. Cart, poor; S. dense; 108.—36. Cob;

S. 30; the capsule thickened and covered with lymph (old) —39. Coach, poor; S. 68.—43. Cob; S. 35; a large fissure in the Spleen, united by cellular bands.—73. Pony; S. 18.

The following were all ordinary sized horses, but their employment was not named.—51. 18 cwt.; S, 44.—52. 15 cwt.; S. 60.—53. 17. cwt.; S. 60.—54. 13 cwt.; S. 24.—55. 14 cwt.; S. 56.—56. 12 cwt.; S. 58.—57. 12. cwt.; S. 48.—58. 12. cwt.; S. 38.—59. 12 cwt.; S. 48.—60 16 cwt.; S. 23.—44. S. 30.—45. S. 35.—46. S. 44.—47. S. 59.—48. S. 64.—49. S. 62.—50. S. 34.—67. S. 32.—68. S. 72.—70 S. 40.—71. S. 41.—72. S. 68.—74. S. 44.—75. S. 36. —76. S. 45.—77. S. 71.—78. S. 50.—79. S. 41.—80. S. 32.—81. S. 32.—108. S. 88.—109. S. 48.—110. S. 82.—111. S. 51. —112. S. 71.

¶ In addition to the animals of this class already enumerated, I have since dissected two Asiatic elephants, two American tapirs, an Indian sow, and collared peccary. I have published an account of some points relating to the anatomy of the elephants and tapirs. (See the "Zoologist," 1853, p. 4239, for the latter animals; the *Lancet* and *Medical Times*, 1854, and the *Proceedings of the Zoological Society*, 1855, for the former.) I will only here mention a few matters that especially relate to the subject I am now investigating.

No. 15. Male Elephant.—No. 1. *(E. Asiaticus) Pneumonia*; B. 3 tons, (about); S. 105 ozs. 1-1,024; L. 540 ozs. 1-99; K. left, 90 ozs. 1-1,194; right, 114 ozs. 1-943; H. 281 ozs. 1-382; Lgs. 766 ozs. 1-140; Brain, 12 lbs. 1-560; A. C. 106 ft. No fat on any part of the body.

16. Female Elephant.—No. 2. *(E. Asiaticus)*; diarrhœa and diseased blood. Mr. Bartlett weighed every part of this animal, and the weight amounted to 5,225 lbs.; S. 9 lbs. 1-580; L. 50 lbs. 1-104; K. 8 lbs. 1-653; H. 23 lbs. 1-227; Lgs. gorged with blood, 107 lbs. 1-48; A. C. œsophagus, 6 ft.; stomach, 3 ft.; small intestines, 74 ft.; cœcum, 5 ft.; other large intestines, 35 ft.—*Total*, 123 feet.

The body of this animal contained abundance of fat, not in solid masses, but interspersed about the viscera, and other parts of the body, so that the opinion that I (with others who had dissected the elephant) expressed respecting the absence of fat, is erroneous.

17 Tapir.—No. 2. Female, aged 5 years; brain symptoms, probably from diseased kidney; the weight of the viscera of this and of No. 3, is in ounces. B. about 3½ cwt.; S 44 1-142; L. 100 1-57; K. 8 1-784; H. 54 1-116; Lgs. 102 1-56; A. C. 72 ft.; Brain, 7 ozs. 384 grs.—*Cerebrum*, 6 ozs. 354; *Cerebellum*, 1 oz. The length of the Spleen of No. 1, was 19½ ins.; of No. 2, when held up, 38 ins.; of No. 3, 19 ins.

18 No. 3. Male, aged 3 years. *(Enteritis)*; B. about 140 lbs.; S. 8 1-280; L. 63 1-35; K. 7 1 320; H. 13 1-172; Lgs. 36 1-162; A. C. 46 feet.

19 Peccary.—No. 2. *(D. Torquatus)*; B. 11 lbs.; S. 161 grs. 1-480.

20 Indian Sow.—(*Sus Indicus*). Abscess in the brain; body about 5 stone; S. 4 ozs. 30 grs., about 1-275.

It will not be out of place here to allude to some points connected with the Spleen and with the portal circulation in some of these animals, which are but rarely dissected. In the Cape Rabbit, *(Hyrax Capensis*, Plate 3, E), in which the Spleen and Stomach are represented, eleven veins are seen passing from the latter organ to the splenic vein. In the Peccary, the

apertures in the main trunk of the splenic vein have, as in most animals, a valvular arrangement; but I have found no semilunar valves in the coronary, mesenteric, or splenic veins, although there is a fold of membrane which guards the two chief *embouchures* into the main trunk. The large saccular stomach of this animal should not be forgotten. I failed to discover in the two specimens the aneurismal dilatations of the aorta spoken of by Cuvier. In the other two specimens of the Tapir, I found only the valves before mentioned (Plate 4), but in one specimen, in the main trunk, *on* the Spleen I counted nearly 100 apertures, all having a valvular form. In the Indian Sow, the coronary and mesenteric veins were free from valves; but in the splenic vein *on* the Spleen there were two valves at the mouth; two an inch behind these, and two the same distance beyond. (Plate 4). In the common Pig, valves are present at the mouth of the splenic vein, and many of the openings into this trunk *upon* the Spleen are partly valvular.

The splenic artery in the Elephant, as in all the Pachyderms that I have examined, runs upon the inner and middle surface of the Spleen: at its commencement it is about the caliber of an ordinary sized goose quill; it gives off three large lateral branches within six inches of its origin to the larger end of the Spleen, and branches of smaller size at intervals of from one to two inches; these, like the main trunk, diminishing in caliber towards the distal extremity of the vessel. The artery is closely adherent to the vein and nerves, by means of cellular tissue.

Structure of the artery.—The cellular coat throughout is very dense. On a careful microscopical examination of the middle coat (so called), no muscular fibres are perceptible; and there is no difference in the appearance of any part of this coat. The cellular and serous coats on a microscopical examination present the usual appearances.

The vein is of large size, measuring at its mouth, when opened, 18 lines. It accompanies the artery throughout its whole course, and although more than 4 feet in length, it receives only 28 branches, forming in this respect a remarkable contrast with the Tapir; the splenic vein of which animal, as before mentioned, has nearly one hundred apertures. In the smaller branches of the splenic vein of the Elephant, the foramina are very numerous. The vein was unfortunately divided close to the Spleen, and the valves, if any, were destroyed. I suspect it will be found hereafter that two are present, near to the mouth of the vein, as in the Tapir. In the other Elephant, the splenic vein was likewise severed before my arrival, and I therefore cannot speak with certainty upon this matter; but the vein *upon* the Spleen, and the gastric veins, contained no valves.

The splenic nerve is very large, being of a flattened form at its entrance into the Spleen, and measuring four lines in its longest diameter. It divides into two branches, which pass on each side of the artery; these, at the distance of four inches, again unite for the space of an inch, and then separate. (Prep 300). There is a trunk of the nerve accompanying each branch of the artery, but numerous small twigs are distributed to the cellular coat, and apparently these have no blood vessels with them. I could not trace these fibres into the yellow coat of the artery.

On a transverse section of the larger portion of the nerve, it is seen, under a power of 20 diameters, to consist of 36 tubules of various sizes, united by cellular tissue. The neurilemma, covering the splenic and other nerves of this animal, is unusually dense. The *absorbent glands* are four or five in number, of an oblong form, about the size of a filbert, and seated in the gastro-splenic omentum. The *trabeculæ*, as in the giraffe, horse, tapir, and many other animals already described, consist of rounded portions of elastic tissue, which, by their union, form meshes, varying in size and shape; pentagons and irregular squares however being the most frequent. Under a power of

twenty or thirty diameters they are better seen, although their great size renders them very apparent (as in other large quadrupeds) to the naked eye. In the elephant, and other vertebrata, I have never detected muscular fibres in the trabeculæ.

I now allude to a subject which requires very careful investigation. The dried preparations of the Spleens of the horse, ox, and elephant (6, 17, and 400), are formed by inflating the splenic vein with air, and then drying. In the first named animal the cells are indistinct, the trabeculæ forming a curious interlacement; the connecting membrane *possibly* being destroyed. In the Spleens of the ox and elephant, the cells, of a rounded form, are quite perfect, and communicate with each other by means of crescent-shaped valve-like openings. The Malpighian bodies are placed within these divisions formed by the trabeculæ, and probably by the coats of the veins, but careful injections and inflations of the Spleen of various animals are yet required to be made before any certain conclusions can be arrived at.

AVERAGES.

¶ *Ungulata.* Selecting the two Elephants, the three Tapirs, the two Peccaries, the common Hog, and the Indian Sow, as examples of this division of the *Pachydermata*, the average weight of the Spleen to the body in these 9 animals, is about 492 ;—of the liver in the tapirs, 1-46 ;—in the elephants 1-101 ;—in the peccaries, 1-26 ;—in the Indian sow, 1-28.

Solidungula. As stated before (p. 22,) the average weight of 76 of the, horses' Spleens (excluding cobs and ponies), was about 58 ozs. ; and assuming that the average weight of the body of these animals, was about 10 cwt., the proportion of the Spleen to the body, will be about 1-308. In a state of nature, this useful animal has probably a much smaller Spleen, but hard work, and over driving, unfortunately so common in this metropolis, are likely to increase the size of an organ so highly vascular as the Spleen. In the fœtal colt, the comparative weight of the Spleen is nearly double the above amount. The Spleen of the zebra, as stated above, was about 1-768 to the body; the animal young, and in excellent condition;—the proportion of the liver to the body in the old blood mare, 1-97 ;—in the zebra, 1-83.

PLATES.

¶ Plate 2, figs. 100 to 106. The length and breadth of the Spleens are in inches. Fig. 100. Elephant, 58. 4¼.—101. Hog, 14. 2.—102. Peccary, 6. 1¼.—103. Tapir, 19½. 5.—104. *Hyrax capensis*, 3. 1¼,—105. Dray Horse, 26, large, and nearly a square foot small end, 1½ in.—106. Zebra, 15. 6.

RUMINANTIA.

The Spleen of all the Ruminants that I have dissected is attached to the left side of the stomach (paunch) by a close adhesion at its larger end, whilst the smaller and thinner edge is more free. In all these animals it is also united to the tendinous part of the diaphragm, (Plates 1, 4, 5, 6, 8 E,) so that when the stomach is much distended, it is not unlikely that the action of this muscle assists by pressure in propelling the blood through the Spleen. In the Brocket, judging from one specimen, (Plate 6, fig. 1 E,) a tendon four inches long extends from the edge of the

Spleen to the stomach, so as to keep the former organ in contact with the latter; I have not observed this in the other Ruminants.

The external surface of the Spleen in nearly all this class of animals is characterized by white markings or dots; most of which are in the form of irregular squares, pentagons, or ovals. These are very distinct in the giraffe, the ox, the sheep, and in most of the deer and antelopes. (Plates 1, 3, 6, 8, 10 E.) The capsule is rather thick, the trabeculæ large and strong, and the Malpighian bodies very distinct, particularly in the sheep and ox; these, as well as the trabecular substance, are well seen in Plates 1, 4, 6 E, but more especially in the lamb. (Plate 11 E). See Plate 3 for some of the above-mentioued.

The trabeculæ are composed, as in all other animals, chiefly of the yellow elastic tissue, and possess about the same amount of elasticity as the yellow coat of the arteries. I have not been able to detect muscular fibre in them.

The following drawing E represents a piece of a sheep's Spleen which I took at the time of the experiment. No. 1, is three-quarters of an inch of elastic tissue unstretched, dissected from the Spleen substance and vessels. No. 2, the same, extended to one-inch and three quarters. Then follow sketches of the extended trabeculæ of the ox, after being exposed to the action of water for a long time. (Prep. 10).

The arrangement of the trabecular substance is very remarkable, and that of the Sheep may be taken as a type of all the Ruminants. Some of the elastic bands are inserted into the capsules singly, others form a fork, and a few have a cross fibre connecting the two prongs; some are broad at the insertion, sending out several filaments. In the centre of the Spleen the trabeculæ divide into branches, which unite the adjoining beams, forming a kind of net work of irregular meshes, through which the Malpighian bodies, spleen-pulp, and vessels are seen. The elastic fibres generally take a vertical direction, whilst the vessels and nerves, for the most part, run horizontally. The artery, in the Sheep, enters the thicker and lower end of the Spleen; it passes through the centre to the apex, keeping about an inch from the upper edge; in its course sending off several lateral branches. In the Stags, Deer, Gazelles, and Antelopes, the arrangement

of the vessels is nearly the same as in the Sheep and Ox:—this is well seen in Prep. 186, of the Virginian Deer's Spleen, where the main branches of the artery run along the thick part, and the smaller branches pass towards the thin edge, to which the branches can be traced.

The arrangement of the splenic vessels in the Ruminants forms a curious contrast with that of some of the *Pachydermata*, (Zebra, Horse, Ass, *e. g.;* Preps. 72, 73), where the artery passes along the inner and upper surface of the Spleen, sending branches at short intervals into its substance. The vein is three times the size of the artery; at its exit from the Spleen its coats are tolerably distinct, but the smaller branches consist only of a very delicate membrane, so thin that it is sometimes difficult to detect its existence—indeed some deny it altogether.

In the Ox, the vein is very large, and the elastic tissue along its sides so placed, as to press upon the canal, and probably by this means assist in propelling the blood out of the Spleen when the organ is in a state of repletion. It is furnished with two valves* near its entrance into the Spleen. Two nerves of large size enter the Spleen with the artery, and divide into branches, which accompany the arterial trunks. The nerves in the Ruminants are very large, but Kölliker, (before cited p. 794,) I think, is mistaken in supposing that they are of uncommon size in the Ruminants; for in some of the *Carnaria*, the lion, tiger, leopard, and bears, as well as some of the *Pachydermata*, they are of equal magnitude, taking into account the size of the animal, as the Plates E, *Ruminantia* and *Pachydermata*, shew. For representations of the Spleens of the Ruminants, see *Ruminantia*, (Plates 1 to 10,) also Preparations, described in the list of Preparations.

The accompanying piece of paper is the exact size and shape of the Spleen of a Bull, weighing (when alive) 2,082 lbs. The length of the Spleen, 2 ft. 5 in.; average breadth, 5 in.; weight 65 oz; proportion to the body, about $\frac{1}{512}$.

The table includes the following Ruminating animals.

1. Sambur Deer. *(C. hippelaphus, India)*. B. about 16 stone, 3,584

* I also find two splenic valves in the vein of the Sheep, about three quarters of an inch from its mouth.

ozs.; S. 8 ozs. $\frac{1}{448}$; L. 104 ozs. $\frac{1}{34}$; H. 32 ozs. $\frac{1}{112}$; Lgs. 128 ozs. $\frac{1}{28}$; A. C. 80 ft.

2. Virginian Deer. *(C. Virginianus)*. (Young;) *Pneumonia;* B. $8\frac{1}{2}$ lbs.; S. 140 grs. $\frac{1}{427}$.

3. Virginian Deer, aged two days. B. about 5 lbs.; S. about 180 grs.; L. 1,600 grs. $\frac{1}{22}$; K. 160 grs. $\frac{1}{220}$; H. 100 grs. $\frac{1}{352}$; Lgs. 1,220 grs. $\frac{1}{28}$; A. C. 18 ft. 5 ins.

4. Musk Deer. *(Moschus Javanicus)*. B. about 2 lbs.: S. 95 grs. $\frac{1}{148}$; L. 620 $\frac{1}{22}$; K. 48 grs. $\frac{1}{293}$; H. 140 grs. $\frac{1}{100}$; Lgs. 245 $\frac{1}{57}$; A. C. 13 ft. 5 ins.

5. Brocket. *(Coassus rufus, South America)*. B. 40 lbs.; S. 790 grs. $\frac{1}{356}$; L. 16 ozs. $\frac{1}{40}$; K. 660 grs. $\frac{1}{426}$; H. 6 ozs. $\frac{1}{106}$ grs.; Lgs. 9 ozs. $\frac{1}{76}$; A. C. 55 ft. 9 ins.

6. Giraffe. *(Cameleopardalis, Africa)*. Diseased liver; hydatids in liver and spleen. The weight of the viscera is given at page 26. S. $\frac{1}{1024}$; L. $\frac{1}{149}$; P. 5,734; K. 1,024; H. 358; Lgs. 179.

7. Harte Beeste *(A. caama, Africa)*. False aneurism in the Spleen. B. about 15 stone (3,360 ozs.); S. about 2 lbs.; full of blood; L. 73 ozs. $\frac{1}{46}$; K. 4 ozs. $\frac{1}{840}$; H. 25 ozs. $\frac{1}{134}$; Lgs. 66 ozs. $\frac{1}{50}$; A. C. 83 ft. 2 in.

8. Striped Antelope. (*A. scripta, W. Africa*). Diseased blood. B. 24 lbs.; S. 560 grs. $\frac{1}{301}$; L. $11\frac{1}{2}$ ozs. $\frac{1}{33}$; P. 110 grs. $\frac{1}{1536}$; K. 340 grs. $\frac{1}{496}$; H. $4\frac{1}{2}$ ozs. $\frac{1}{85}$; Lgs. 8 ozs. $\frac{1}{48}$.

9. Indian Antelope. *(A. cervicapra)*. B about 20 lbs.; S. 340 grs. $\frac{1}{411}$; K. 443 grs. $\frac{1}{317}$; H. 4 ozs. $\frac{1}{80}$; Lgs. 6 ozs. $\frac{1}{53}$; A. C. 33 ft. 6 ins.

10. Duyker-boc. *(A. cephalophorus, Africa)*. B. about 20 lbs; S. 940 grs. $\frac{1}{149}$.

11. Spring-boc. *(A. euchore, Africa)*, *Pneumonia*. B. weight not entered, nor weight of Spleen; but this was, judging from memory, of the ordinary size of the organ in the Antelopes; L. 7 ozs. 220 grs.; P. 150 grs.; K. 485 grs.; H. 4 ozs. 80 grs.; Lgs. 11 ozs., (inflamed;) A. C. 38 ft.

12. Indian Gazelle. *(A. Dorcas)*. *Pneumonia;* B. 30 lbs.; S. about 550 grs. $\frac{1}{384}$; L. 7 ozs. $\frac{1}{68}$; P. 561 grs. $\frac{1}{374}$; K. 560 grs. $\frac{1}{377}$; H. 4 ozs. $\frac{1}{120}$; Lgs. 15 ozs. (inflamed), $\frac{1}{32}$; A. C. 44 ft.

13. Young Gazelle. *(Indian)*. B. $2\frac{1}{2}$ lbs.; S. about 180 grs. $\frac{1}{97}$; L. 770 grs. $\frac{1}{22}$; H. 340 $\frac{1}{51}$; Lgs. 600 grs. $\frac{1}{29}$.

14. Moufflon. *(Ovis Musmon, Europe)*. B. 15 lbs. 4 ozs.; S. 280 grs. $\frac{1}{383}$; L. 8 ozs. $\frac{1}{30}$; K. 540 grs. $\frac{1}{198}$; H. 1,210 grs. $\frac{1}{88}$; Lgs. 6 ozs. $\frac{1}{40}$; A. C. 46 ft. 7 ins.

15. Lamb. Cooped, February. Very fat. B. 38 lbs.; S. 550 grs. $\frac{1}{486}$.

16. Angora Kid. B. 4 lbs. 4 ozs.; S. 65 grs. $\frac{1}{460}$; L. 720 grs. $\frac{1}{41}$; K. 140 grs. $\frac{1}{213}$; H. 300 grs. $\frac{1}{99}$; A. C. 30 ft.

17. Ox. (*Bos taurus*). 3 years; thin. Diarrhœa; over driven. B. about 5,120 ozs.; S. 26 ozs. $\frac{1}{196}$; L. 224 ozs. $\frac{1}{22}$; K 20 ozs. $\frac{1}{256}$; H. 66 ozs. $\frac{1}{77}$; Lgs. 176 $\frac{1}{29}$; A. C. 123 ft.

¶ I have, besides the above, dissected many scarce animals in this class, and in all I have weighed the viscera, and taken sketches of them by measurement; my space, however, will only allow me to allude very briefly to a few points that especially relate to the Spleen, and I first give the relative weight of this organ to the body in the undermentioned.

18. Llama. (*Auchenia glama, Peru*). Young; B. 35 lbs.; S. 1-820.—19. No. 2. B. about 2 cwt.; S. 1-1433.

20 Guanaco (*Auchenia huanaca, Chili*). B about 1½ cwt.; S. 1-1606. —21. No. 2. B. about 1½ cwt.; S. 1-2104.

22. Rein Deer. (*C. tarandus, Norway*). Male, age 8 years; B. about 2 cwt.; S. 1-793; A. C. 124 ft.—22. No. 2. Female, age 3 years; B. 1½ cwt.; S. 1-398.—23. Fœtus of the latter, near the first time; weight 8 lbs.; S. 71 grs. 1-793.

24. Sambur Deer. No. 2. S. 1-440.—25. Molucca Deer. (*C. Rusa Molluccensis*). S. 1-336.—26. Texan Deer. (*C.———? America*). S. 1-560.—27. Rocky Mountain Deer. (*C.———?*) S. 1-358.—28. Axis Deer (fœtal). (*C. axis, India*). B. 4½ lbs.; S. 125 grs. 1-253.

29. Giraffe. No. 2. B. about 18 cwt.; S. 1-733; A. C. 209 ft.—30. Leucoryx (aged 12 months). (*A. Leucoryx, Nubia*). Diseased lungs; B. about 65 lbs.; S. 1-199.—31. No. 2. Old male, the size of the last. Diseased lungs; B. about 1½ cwt.; S. 1-268.—32. Addax. (*A. addax, Africa*). Diseased lungs; S. 1-112.—33. Bonte-boc. (*A. pygarga, Africa*). S. 1-672.—34. Duyker-boc. No. 2. S. 1-130.—35. Bubaline Antelope. (*A. Bubalis, Africa*). Very thin; tuberculated lungs; B. 80 lbs.; S. 3 lbs. 2 ozs. 1-25. (diseased).—36. Isabelline Antelope, Reit-boc. (*A. Isabellina, Africa*). S. 1-429.—37. Indian Gazelle. No. 2. S. 1-475.—38. (*Gazella Bennettii, Africa*). S. 1-440.—39. Dorcas Gazelle (*A. Dorcas, Africa*). S. 1-590.—40. A Fœtus from the last, weighing 15 ozs. S. 1-188.—41. (*Gazella Vera, Morocco*). S. 1-320

42. Moufflon. No. 2. S. 1-300.—43. Goat. No. 2. S. 1-586.—44. Sheep. (*Ovis aries*). B. 62 lbs.; S. 1-285; L. 1-49.—45. Lamb at birth. B. 8½ lbs.; S. 1-249.—46. No. 2. B. 8 lbs.; S. 1-225.

The connexion of the Spleen with the diaphragm in most of the animals of this class, and its close adhesion to the paunch, as I have before mentioned, are features of great interest in the inquiry respecting the function of the Spleen. In the Llamas and Guanacos, however, the Spleen is not attached to the diaphragm. The stomach in these animals is large, and is furnished as in the Camel and Dromedary, with water-bags. The splenic artery, too, in the Llamas and Guanacos, before entering the Spleen, divides into three branches; and I have observed the same arrangement in the Rein Deer, and in one species of Goat. (See Preparations). The artery in most of the Ruminants enters as a single trunk at the anterior and thicker portion of the Spleen.

VALVES.

¶ I have found valves in the splenic vein of all the Ruminants I have dissected since the formation of the last table. In all, two valves are seated near to the mouth of the vein. In the Giraffe, first examined, I found two

pairs of valves as before mentioned, (Prep. 12); but in the other specimen, (Prep. 350), there are three pairs of valves within a space of two inches, and if the coronary and intestinal veins had been carefully examined, it is probable that numerous valves would have been found in them. They were present (as in many of the Ruminants) in both renal veins. In the Rein Deer they exist in great abundance, not only in the abdominal veins, but all the cutaneous veins are likewise plentifully supplied with them; a beautiful provision of nature to assist the onward current of the blood to the heart in an animal often exposed to intense cold. In one of the coronary veins of an Indian Gazelle I have counted six pairs of valves, so placed as to prevent the blood regurgitating into the stomach. In the old Leucoryx they were equally numerous; and in this animal the main trunk of the splenic vein, within the Spleen, received several hundred small branches, their mouths having a crescentic edge at the posterior part. In the Guanaco, I found three pairs of valves in the splenic vein; two at the mouth of the pancreatic, and four pairs in the larger mesenteric vein. I could occupy many pages in describing these valves; but in order to save the time of the reader I have depicted many of them in Plate IV. of this Treatise. It must be borne in mind that they are never found in the *vena portæ* itself, and that they are always so placed as to prevent regurgitation of the blood, and thereby to assist its progress towards the liver.

I have injected the Spleens of many of the Ruminants with various substances, but at present I must speak with some degree of doubt as to the distribution of the vessels to the *Malpighian* bodies.—(See Plate 3.) A few months since I injected the Spleens of two lambs (at birth); in one, the vein was injected with white lead and turpentine. The veins on the surface of the *Malpighian* bodies present a stellate form; one large trunk receives 5 or 6 branches, and the latter are formed by innumerable twigs of small size, which appear to surround the Malpighian corpuscles.

The artery of the other lamb I injected in the same manner. With the naked eye, a few small vessels are seen upon the exterior of the corpuscle, which is red; probably, from the blood having been forced into the capillaries. Under a power of 40 diameters, vessels in greater number were seen upon the capsule, but I failed to trace them to the interior. In the young *Leucoryx* (Plate IV), the same arrangement was observed.

The great length of the alimentary canal in many of these animals will surprise some of my readers, more especially the intestinal tube of the giraffes. The measurements differ very materially from those before quoted in *other* specimens examined by Professor Owen (*Proceedings of Zoological Society.*) It will remain for future observers to determine which is the most correct. I may observe, that it takes a long time to examine properly the alimentary canal of a ruminating animal, and that in every instance I have performed this tedious task myself, and that in many cases (as before stated) the small intestine was *pulled* through the mesentery; the latter membrane remaining uncut.

AVERAGES.

¶ So many of these animals were in a diseased state that it is difficult to give a correct average. In the first table, the Sambur Deer, the Harnessed Antelope, the Moufflon, and the Ox, may be taken as fair specimens of these divisions. About the average proportion of some of the viscera to the body is,—S. 1-332; L. 1-29; K. 1-316; H. 1-90; Lgs. 1-36. But in the above, and in other animals kept in confinement, all these organs are but rarely in a normal condition, and hence the difficulty of drawing correct conclusions. In the second table, the Spleens of the Guanacos and Llamas average about 1489, as compared with the weight of the body; but in several of the Deer

and Antelopes, the proportionate weight of the Spleen will be found much larger.

PLATES.

¶ Figures 107 to 137, Plate 2, represent the Spleens of the Ruminants. The length is *first* stated in inches, the *circumference* afterwards.—107. Guanaco, 5. 13.—108. Llama, 3¼. 8.—109. Musk-Deer, 2. 5.—110. Sambur Deer, 12½. 30.—111. Virginian Deer, 6. 16.—112. Molucca Deer, 3¾. 10½.—113. Californian Deer, 3¾. 10½.—114. Rein Deer, 12. 33.—115. Large Indian Deer——? 13 30.—116. Mexican Deer, 7¼. 20.—117. Axis Deer, *(fœtal)*, 1¾. 4½.—118. Rocky Mountain Deer, 6. 18.—119. Brocket, 6¼. 17½.—*Antelopes.* 120. Giraffe, 12. 36.—121. Harte-Beeste, about 12½. 32.—122. Striped Antelope, 5. 12.—123. Indian Antelope, 3¾. 11.—124. Spring-boc, 4. 11.—125. Duyker boc, 6½. 14½.—126. Bonte-boc, 8. 19.—127. Reit-boc, 6. 15.—128. Leucoryx, 19. 30.—129. Addax, (enlarged,) 12½. 31.—130. Indian Gazelle, 4½. 11½.—131. *Gazella vera*, 6. 10¾.—132. Bonelli's Gazelle, 5¼. 13.—133. Dorcas Gazelle, 3½. 10½.—134. Moufflon, 4. 10½.—135. Sheep, 4½. 12.—136. Goat, 3¼. 8.—137. Ox, 30. 69.

CETACEA.

¶ In this order I have only had an opportunity of examining a small specimen of the common Porpoise *(D. phocæna)* (fœtal). The Spleen, seated to the left of the stomach, was small, oblong, and not lobated. It will be interesting hereafter to ascertain the relative weight of the Spleen to the body in all the families of the *cetacea*.

AVES.

In the anatomy of Birds, there is one peculiarity that it is important to remember, as it bears somewhat upon the portal circulation which receives part of the blood from the lower extremities, and therefore, the blood of the spleen, pancreas, and intestines, is not solely employed in the secretion of bile as in the Mammalia.*

There is another point of interest, too, as regards the Spleen, viz.,—the difference between this organ (if any) in those birds with a gizzard and those with a stomach, like the gulls, cormorants, herons, and some of the rapacious birds.

A curious fact may likewise be mentioned respecting the gall-bladder, viz.,—that nearly all the birds with a membranous stomach possess it, whilst it is found in none of the pigeons nor parrots.

I cannot discover that the character of the stomach at all influ-

* I have recently shown at the London Physiological Society the Spleen of birds injected through the femoral vein.—*Medical Times*, July, 1855. *After note.*

ences the shape or structure of the Spleen? Take the heron and cock for example. In the one, there is a thick muscular gizzard, in the other, a membranous stomach with a proventriculus furnished with large glands.

The situation of the Spleen of the bird, and the non-muscular diaphragm, are matters also of importance, as regards the physiology of the organ, it being placed behind the membranous diaphragm on the right side, or between the two orifices of the stomach or gizzard.

The large size of the kidneys also, reaching to the diaphragm (membranous), the form of the blood corpuscles, and the higher temperature of these animals, and their mode of respiration, should not be forgotten.

ACCIPITRES.

The size of the Spleen of the birds of this class is a proof that great muscular power has little to do with the magnitude of the Spleen.

The Spleen of the rapacious birds, in all that I have examined, is of a rounded form, like that of the *Gallinæ;* it is placed between the orifices of the stomach.

The nerve in some of these is large (see Preparation of Spleen of Condor, 107); and the artery in all is of large size. (See drawing of the vessels of the Harpy Eagle, Plate 7 E).

The birds of this division described in the table are the following. The weight of the viscera is given in grains.

In this, as in all the other tables, where the cause of death is not stated, it was doubtful.

1. Condor. *(V. gryphus, S. America).* Obstructed bowels. B. 13 lbs.; thin; S. 45 $\frac{1}{2034}$; L. 1,540 $\frac{1}{59}$; P. 58 $\frac{1}{1577}$; K. 90 $\frac{1}{1016}$; H. 660 $\frac{1}{138}$; Lgs. about 130 $\frac{1}{704}$; A. C. 6ft. 3 ins.

2. Angola Vulture. *(V. Angolensis, S. America).* Young; Diseased kidneys. B. 3 lbs. 2 ozs.; thin; S. 20 $\frac{1}{1100}$; L. 440 $\frac{1}{50}$; K. 140 $\frac{1}{57}$; H. 80 $\frac{1}{275}$; Lgs. 132 $\frac{1}{93}$; A. C. 4 ft. 5 ins.

3. Sea Eagle. *(F. Haliaetus, Europe).* The pancreas hard and large. B. 3 lbs. 4 ozs.; thin; S. 12 $\frac{1}{1906}$; L. 660 $\frac{1}{34}$; K. 128 $\frac{1}{178}$; H. 540 $\frac{1}{42}$; Lgs. 145 $\frac{1}{93}$.

4. Harpy Eagle. *(Harpyia destructor, S. America).* Young; B. 2 lbs.; thin; S. 29 $\frac{1}{485}$; L. 1,762; tuberculated $\frac{1}{8}$; P. 34 $\frac{1}{414}$; K. 145 $\frac{1}{97}$; H. 472 $\frac{1}{29}$; Lgs. 182 $\frac{1}{71}$; A. C. 4 ft. 6 ins.

5. Golden Eagle. *(F. Chrysaetos, Europe).* Killed by the claw of another eagle, which passed through the skull to the brain. B. 8 lbs.; S. 15 $\frac{1}{3754}$; L. 660 $\frac{1}{85}$; K. 100 $\frac{1}{563}$; H. 380 $\frac{1}{148}$; Lgs. 360 $\frac{1}{153}$; A. C. 5 ft. 3 ins.

6. Golden Eagle. No. 2. Kidneys large. S. 18 $\frac{1}{3128}$; L. 70 $\frac{1}{80}$; K. 212 $\frac{1}{265}$; H. 440 $\frac{1}{128}$ Lgs. 280 $\frac{1}{201}$; A. C. 5 ft. 9 ins.

7. Rufous Eagle. *(F. rapax S.)* B. 1 lb. 12 ozs.; S. enlarged, 23 $\frac{1}{553}$; L. enlarged, 725 $\frac{1}{16}$; P. 32 $\frac{1}{560}$; K. 190 $\frac{1}{136}$; H. 210 $\frac{1}{58}$; Lgs. 180 $\frac{1}{68}$ A. C. 5 ft. 10 ins.

8. Bonelli's Eagle. *(F. Bonellii).* Kidneys large. B. 3½ lbs.; S. enlarged, 56 $\frac{1}{440}$; L. enlarged, 1,158 $\frac{1}{21}$; P. 36 $\frac{1}{684}$; K. 160 $\frac{1}{154}$; H. 750 $\frac{1}{32}$; Lgs. 520 $\frac{1}{49}$; A. C. 5 ft. 10 ins.

9. Little Eagle. *(F. pennatus, Europe).* B. 9 ozs.; thin; S. 4 $\frac{1}{990}$; L. 120 $\frac{1}{33}$; K. 30 $\frac{1}{132}$; H. 70 $\frac{1}{56}$; Lgs. 51 $\frac{1}{77}$; A. C. 2 ft. 8 ins.

10. African Falcon. ——? B. 5½ ozs.; very thin; S. 1 $\frac{1}{2420}$; L. 40 $\frac{1}{60}$; K. 7 $\frac{1}{345}$; H. 20 $\frac{1}{121}$.

11. *Falco Biarmicus.* Lardaceous tumour in the chest. B. 20 ozs. thin; S. 6 $\frac{1}{1433}$; L. 220 $\frac{1}{40}$; K. 41 $\frac{1}{214}$; H. 128 $\frac{1}{68}$; Lgs. 120 $\frac{1}{73}$; A. C. 3 ft.

12. Longeared Owl *(S. otus, Europe).* (Young;) Poisoned by arsenic, accidentally; lived for several weeks. B. 7 ozs. thin; S. 1 $\frac{1}{3080}$; L. 41 $\frac{1}{75}$; P. 2 $\frac{1}{1540}$; K. 2 $\frac{1}{1540}$; H. 19 $\frac{1}{162}$; Lgs. 21 $\frac{1}{146}$; A. C. 2 ft. 1 in.

13. Barn Owl. *(S. flammea, Europe).* (Shot.) B. 10 ozs.; S. 2 $\frac{1}{2200}$.

¶ All the birds in the above table were in confinement except the last. In several, the body was wasted, and the viscera increased in size, but I think the specimens, (Nos. 2, 3, 5, and 11,) may be taken as tolerable examples of proportion.

I have since dissected the undermentioned birds of this order. The first to No. 20 were in a wild state, and in good condition; the others had been in confinement.

14. Peregrine Falcon. *(F. peregrinus.)* B. 2 lbs. 5 ozs.; S. 14 1-1162; L. 452 1-36; K. 55 1-296; P. 18 1-904; H. 300 1-54; Lgs. 210 1-77; A. C. 4 ft. 1 in. This bird was shot in winter, the fat on its abdomen weighed 176 grains.—15. Common Buzzard. *(B. vulgaris.)* B. 24 ozs.; S. 6 1-1760; L. 257 1-41; K. 45 1 234; H. 125 1-184; Lgs. 90 1-117; A. C. 4 ft. 8 ins.—16. Goshawk. *(F. palumbarius.)* B. 23 ozs.; S. 6½ 1-1556; L. 280 1-36; P. 10 1-1012; K. 29 1-348; H. 214 1·47; Lgs. 120 1-84; A. C. 2 ft. 6 ins.—17. Goshawk. No. 2. S. 1-1085; L. 1-43; A. C. 2 ft. 11 ins.—18. Goshawk. No. 3. S. 1-1508.—19. Sparrow Hawk. *(F. nisus.)* B. 5¼ ozs.; S 2 1-1155; K. 5 1-462; H. 23 1-100; Lgs. 24 1-96; A. C. 22½ ins.—20. Sparrow Hawk. No. 2. (Young; kept for some time in confinement.) B. 5½ ozs.; S. 2 1-6 1-1116; L. 140 1-17; P. 4½ 1-537; K. 17 1-142; H. 22 1-110; Lgs. 24 1-100. —21. Kestrel. *(F. tinnunculus.)* S. 1-1149. The above mentioned birds are found in England.

The following, with the exception of the Barn Owls, werc in confinement;

the *proportion* of the Spleen to the *body* is only given. 22. Golden Eagle. 7¼ lbs.; S. 20, 1-2552—23. Montague's Harrier. *(F. hyemalis)*. S. 1-2640. —24. Marsh Harrier. *(F. rufus)*. S. 1-1040.—25. Eagle Owl. *(S. Orientalis, India)*. S. 1-3017.—26. Short Eared Owl. *(S. Brachyotos)*. S.1-2053. —27. Little Owl. *(S. passerina.)* S. 1-1650. 28. Tengmalm's Owl. *(S. Tengmalmi)*. S. 1-1408.—29. Barn Owl, No. 2. S. 1-2346.—30. Barn Owl, No. 3. S. 1-1944.

AVERAGES.

¶ As stated above, the Angora Vulture, Golden Eagle, Sea Eagle, and *(Falco Biarmicus)*, were tolerable specimens of healthy birds. The average proportion of the viscera to the body in these, is S. 1,891; L. 51; K. 203; H. 128; Lgs. 133. In four birds from the second table, living in a state of nature, the Peregrine Falcon, Goshawk, Common Buzzard, and Sparrow. Hawk, the proportions are as follow:—S. 1337; L. 30; P. 817; K. 245; H. 70; L. 89.

PLATES.

The Spleens of the accipitrine birds are figured in Plate 2. The Spleens are reduced to about the undermentioned proportions. Fig. 138. Condor, $\frac{1}{3}$ —139. Angola Vulture, $\frac{1}{3}$.—140. Sea Eagle, $\frac{1}{4}$.—141. Harpy Eagle, $\frac{1}{4}$.—142. Golden Eagle, $\frac{1}{4}$.—143. Rufous Eagle, $\frac{1}{3}$.—144. Bonelli's Eagle, $\frac{1}{4}$. —145. Little Eagle, $\frac{1}{4}$.—146 Black Indian Hawk, $\frac{1}{3}$.—147. Peregrine Falcon, $\frac{1}{4}$.—148. Sparrow Hawk, $\frac{1}{3}$.—149. Kestrel, $\frac{1}{3}$.—150. Goshawk, $\frac{1}{3}$.—151 Common Buzzard.—152. Montague's Harrier, $\frac{1}{3}$.—153. Marsh Harrier, $\frac{1}{2}$. —154. Indian Eagle Owl, $\frac{1}{2}$.—155. Virginian Eagle Owl, $\frac{1}{2}$.—156. Tengmalm's Owl, $\frac{1}{2}$.—157. Little Owl, $\frac{1}{2}$.—158.—Barn Fowl, $\frac{1}{2}$.—159. Short Eared Owl, $\frac{1}{2}$.

PASSERINÆ.

The passerine birds have nearly all a long cylindrical Spleen seated near to the cardiac orifice. The Spleens of some of these birds are curiously mottled, the part between the trabeculæ presenting a yellowish transparent aspect. In the swallow and martin the Spleen is of a yellow hue. (See note page 38.)

The table consists of thirty-seven specimens of the Birds of this order.

1. Red-backed Shrike. (*L. Collurio*). B. 440; S. $\frac{1}{4}$ $\frac{1}{1760}$; L. 17 $\frac{1}{25}$; H. 4½ $\frac{1}{97}$; Lgs. 5½ $\frac{1}{80}$; A. C. 11 ins.

2. Flycatcher. *(M. griseola)*. B. 220; S. $\frac{1}{2}$ $\frac{1}{440}$; L. 10 $\frac{1}{22}$; A. C. 9 ins.

3. Blackbird. *(T. Merula.)* B. 925; S. 2 $\frac{1}{462}$; L. 42 $\frac{1}{22}$; H. 14 $\frac{1}{66}$; Lgs. 20 $\frac{1}{46}$; A. C. 15 ins.

4. Whin-chat. *(M. rubetra)*. B. 220; S. $\frac{1}{2}$ $\frac{1}{440}$; L. 12 $\frac{1}{18}$; K. 2 $\frac{1}{110}$; H. 3 $\frac{1}{73}$; Lgs. 3 $\frac{1}{73}$; A. C. 7 ins.

5. Robin. *(M. rubecula)*. B. 280; S. $\frac{1}{5}$ $\frac{1}{1400}$; L. 13 $\frac{1}{21}$; H. 3 $\frac{1}{93}$; Lgs. 3 $\frac{1}{93}$; A. C. 9 ins.

6. Nightingale. *(M. luscinia)*. B. 220; S. $\frac{1}{4}$ $\frac{1}{880}$; L. 8 $\frac{1}{27}$; H. 2½ $\frac{1}{88}$; Lgs. 2¾ $\frac{1}{80}$; A. C. 7 ins.

7. Wren. *(M. Troglodytes)*. B. 126; S. $\frac{1}{5}$ $\frac{1}{630}$; L. 9 $\frac{1}{14}$; K. 1 $\frac{1}{126}$; H. 3 $\frac{1}{42}$; Lgs. 2 $\frac{1}{62}$; A. C. 6½ ins.

8. Specimen No. 2. B. 140; S. $\frac{1}{3}$ $\frac{1}{420}$; L. 8 $\frac{1}{17}$; H. 2 $\frac{1}{70}$; Lgs. 2 $\frac{1}{70}$; A. C. 7 ins.

9. Gold-crested Wren. *(M. regulus)*. B. 60; S. $\frac{1}{6}$ $\frac{1}{360}$; L. 6 $\frac{1}{10}$; K. 1 $\frac{1}{60}$; H. 1½ $\frac{1}{40}$; Lgs. 1½ $\frac{1}{40}$; A. C. 5½ ins.

10. Pied Wagtail. *(M. boarula)*. B. 345; S. ½ $\frac{1}{690}$; L. 12 $\frac{1}{28}$; K. 2½ $\frac{1}{138}$; H. 6 $\frac{1}{57}$; Lgs. 4 $\frac{1}{86}$; A. C. 6½ ins.

11. Yellow Wagtail. *(M. flava)*. B 480; S. $\frac{1}{3}$ $\frac{1}{1440}$; L. 10 $\frac{1}{48}$; H. 3 $\frac{1}{160}$; Lgs. 3 $\frac{1}{160}$; A. C. 6 ins.

12. Grey Wagtail. *(M. cinerea)*. About the same as the last.

13. Wheat-ear. *(S. œnanthe)*. B. 282; S. $\frac{1}{3}$ $\frac{1}{846}$; L. 10 $\frac{1}{28}$; H. 4 $\frac{1}{70}$; Lgs. 5 $\frac{1}{56}$; A. C. 9 ins.

14. Swallow. *(H. rustica)*. B. 288; S. $\frac{3}{4}$ $\frac{1}{432}$; L. 14 $\frac{1}{20}$; H. 5 $\frac{1}{57}$; Lgs. 4 $\frac{1}{72}$; A. C. 6 ½ ins.

15. Martin. *(H. urbica)*. B. 290; S. $\frac{3}{4}$ $\frac{1}{386}$; L. 15 $\frac{1}{19}$; K. 2 $\frac{1}{145}$; H. 4 $\frac{1}{72}$; Lgs. 3 $\frac{1}{58}$; A. C. 6 ins.

16. Bank Swallow. *(H. riparia)*. B. 185; S. $\frac{1}{4}$ $\frac{1}{740}$; L. 8 $\frac{1}{23}$; H. 3 $\frac{1}{61}$; Lgs. 2 $\frac{1}{92}$; A. C. 6. ins.

17. Goatsucker. *(Caprimulgus.)* B. 985; S. $\frac{3}{4}$ $\frac{1}{1313}$; L. 25 $\frac{1}{39}$; K. 5 $\frac{1}{197}$; H. 8 $\frac{1}{123}$; Lgs. 8 $\frac{1}{123}$; A. C. 17 ins.

18. Specimen No. 2. B. 1,100; S. 1 $\frac{1}{1100}$; L. 23 $\frac{1}{47}$; H. 10 $\frac{1}{110}$; Lgs. 10 $\frac{1}{110}$; A. C. 16 ins.

19. Skylark. *(A. arvensis)*. B. 440; S. 1 $\frac{1}{440}$; L. 19 $\frac{1}{23}$; H. 7 $\frac{1}{62}$; Lgs. 8 $\frac{1}{55}$; A. C. 12 ins.

20. Titlark. *(A. pratensis)*. B. 225; S. $\frac{1}{3}$ $\frac{1}{615}$; L. 10 $\frac{1}{32}$; H. 4 $\frac{1}{56}$; Lgs. 5 $\frac{1}{45}$; A. C. 9 ins.

21. Blue Tit. *(P. cœruleus)*. B. 160; S. ½ $\frac{1}{320}$; L. 7 $\frac{1}{22}$; H. 2½; $\frac{1}{64}$; Lgs. 2½ $\frac{1}{64}$; A. C. 5½ ins.

22. Chaffinch. *(F. cœlebs)*. B. 270; S. 1 $\frac{1}{270}$; L. 8 $\frac{1}{33}$; H. 4 $\frac{1}{67}$; Lgs. 3 $\frac{1}{90}$; A. C. 12 ins.

23. Grey Linnet. *(F. cannabina)*. B. 280; S. ½ $\frac{1}{560}$; L. 6 $\frac{1}{46}$; H. 3 $\frac{1}{70}$; Lgs. 3 $\frac{1}{70}$; A. C. 7 ins.

24. Sparrow. *(F. domestica)*. B. 410; S. $\frac{3}{4}$ $\frac{1}{546}$; L. 15 $\frac{1}{27}$; H. 5 $\frac{1}{82}$: Lgs. 3 $\frac{1}{136}$; A. C. 10 ins.

25. Tree Sparrow. *(E. montana)*. B. 335; S. ½ $\frac{1}{670}$; L. 8 $\frac{1}{41}$; H. 3½ $\frac{1}{95}$; Lgs. 3 $\frac{1}{111}$; A. C. 6 ins.

26. Bullfinch. *(P. vulgaris)*. B. 280; S. $\frac{1}{4}$ $\frac{1}{1120}$; L. 15 $\frac{1}{18}$; H. 4 $\frac{1}{70}$; Lgs. 5 $\frac{1}{56}$; A. C. 19 ins.

27. Grosbeak. *(Loxia)*. (In confinement; very thin) B. 200; S. 1 $\frac{1}{200}$.

28. Starling. *(S. vulgaris).* B. 1,000; S. 2 $\frac{1}{500}$; L. 45 $\frac{1}{22}$; H. 10 $\frac{1}{100}$; Lgs. 10 $\frac{1}{100}$; A. C. 13 ins.

29. Raven. *(C. corax).* (In confinement; soft liver.) B. 28 ozs.; S. 10 $\frac{1}{1232}$; L. 280 $\frac{1}{44}$; P. 20 $\frac{1}{616}$; K. 30 $\frac{1}{410}$; H. 150 $\frac{1}{82}$; Lgs. 124 $\frac{1}{99}$; A. C. 36 ins.

30. Rook. *(C. frugileus.)* B. 14 ozs.; S. 7 $\frac{1}{880}$; L. 206 $\frac{1}{29}$; H. 75 $\frac{1}{82}$; A. C. 58 ins.

31. Indian Hunting Crow. *(C. speciosus.)* (In confinement). B. *about* 10 ozs.; S. 4 $\frac{1}{1100}$; L. 175 $\frac{1}{25}$; H. 48 $\frac{1}{91}$; Lgs. 58 $\frac{1}{75}$; A. C. 24 ins.

32. Jay. *(C. glandarius.)* B. 5 ozs. 292 grs.; S. 2½ $\frac{1}{990}$; L. 51 $\frac{1}{48}$; H. 25 $\frac{1}{99}$; Lgs. 45 $\frac{1}{55}$; A. C. 30 ins.

33. King Fisher. *(A. Ispida.)* (Young.) B. 320; S. $\frac{1}{6}$ $\frac{1}{1920}$; L. 32 $\frac{1}{10}$; K. 2 $\frac{1}{160}$; H. 7 $\frac{1}{45}$; Lgs. 7 $\frac{1}{45}$; A. C. 9 ins.

34. Specimen, No. 2. B. 380; S. $\frac{1}{2}$ $\frac{1}{760}$; L. 10 $\frac{1}{38}$; H. 5 $\frac{1}{76}$; Lgs. 4 $\frac{1}{95}$; A. C. 12 ins.

Young passerine Birds.

35. Robin. Five days. B. 80; S. very small; L. 3 $\frac{1}{26}$; H. 1 $\frac{1}{80}$; Lgs. 1½ $\frac{1}{53}$.

36. Wren. Eighteen days; full fledged. B. 160; S. $\frac{1}{10}$ $\frac{1}{1600}$; L. 5 $\frac{1}{32}$; H. 1½ $\frac{1}{106}$; Lgs. 1 $\frac{1}{160}$; A. C. 5¼.

37. Yellow Bunting. Six days. B. 115 $\frac{1}{920}$; L. 7 $\frac{1}{16}$; H. 1½ $\frac{1}{76}$; Lgs. 3 $\frac{1}{38}$.

¶ The nature of the food of these birds is described in the table. A few, the Shrike, Flycatcher, the *Hirundinaceæ* and the *Caprimulgi*, are solely insectivorous feeders; the Kingfisher is a fish eater; the other birds are nearly, if not all, animal and vegetable feeders; for in the *passerine* birds, the food of which is said to be vegetable, I have often found insects in their gizzards. The birds above described were, for the most part, living in a state of nature; they were nearly all shot by myself, and examined a short time after death.

As it is important to examine many animals of the same class, before accurate opinions can be arrived at respecting the weight of the Spleen, I add the following, giving only the weight of the *Spleen*, as compared with that of the *body*. The Latin name is not repeated when the bird has been mentioned before. The foreign birds which are last noted were in confinement, the others were all shot.

Red Shrike, 880. Grey Shrike. *(L. excubitor).* 1,200.—Fieldfare. *(T. pilaris).* 1,320.—Blackbird, (8 specimens), 760, 1,520, 1,104, 1,106, 906, 1,406, 1,387, 1,500.—Redwing. *(T. iliacus).* 2,560, 1,312, 1,520. These last birds were examined in very cold weather, when the Spleen is generally smaller than in summer.—Missel Thrush. *(T. viscivorus).* 1,000.—Thrush, 1,575, (winter).—Fly-catcher. *(M. luctuosa).* 452.—Wren, (three specimens), 650, 532, 477.—Robin, (two specimens), 1,041, 1,044, (winter.)—Magpie. *(C. pica).* B. 8 ozs.; S. 391; L. 25; P. 320; K. 176; H. 85; Lgs. 92; A. C. 19 ins.—Starling (two specimens), 880, 1,040.—Jay, 660.—Rook, (winter), 2,145; (summer,) 1,320.—

Hooded Crow. (*C. cornix*). 1,496.—Creeper. (*C. familiaris*). 544.—Wryneck. (*Yunx torquilla*). 1,610.—Tree Pipit. (*A. arboreus*). 524.—Skylark, (five specimens), 1,240, 760, 604, 1,240, 755.—Chaffinch, (four specimens), 662. 398, 462, 662.—Hawfinch. (*F. caccothraustes*). 1760.—Yellow Linnet, (*F. chloris*). 898.—Grey Linnet, 810.—Black Cap, 627.—Red Linnet, (Two specimens), 693, 546.—Blue Tit, 366, (summer); 1062, (winter).—Wheat Ear, (Three specimens), 802, 1,194, 700.—Sand Martin, 1,134.—Swallow, 580.—In the last two birds, examined in autumn, the Spleen was of a light red colour,—not yellow, as before mentioned. In the hedge sparrow, reed sparrow, goldfinch, siskin, and other small passerine birds that I have examined, the relative weight of the Spleen to that of the body varied from 500 to 750. The next described were all in confinement.

Mocking Bird. (*Mimus Polyglottus*). (Two specimens,) 480, 2,060.—Scarlet Tanager. (*T. flammiceps*). 560.—Amaduvat. (*Amadina*). 1780.—Virginian Nightingale. (*M. Virginiana*).—Hoopoe. (*Upupa epops*). (Two specimens,) 2,860, 1,320.—Blackheaded Manakin (*Pardalotus, Australia*) 560.—Canary (*F. canaria*). 1 600.—Rice Bird. (*Loxia oryzivora*). 1-600.—Larkheaded Bunting, 1-800.—Painted Finch. (*E. picta*). 1,000.

The passerine birds are probably more numerous than all the other orders put together; they all, as far as my examinations have gone, have a cylindrical shaped Spleen, and the organ is of larger proportionate size in these birds than in the other classes.

AVERAGES.

¶ Selecting from the first table six birds of this country, of different genera, with which the reader is probably acquainted, viz.: the Shrike, Blackbird, Jay, Sparrow, Martin, and Nightingale, the general average of these viscera to the body is, S. 868; L. 28; H. 84; Lgs. 71. The kidney and pancreas were not weighed in the above specimens of *wild* birds; but the former organ varied from 1-100 to 1-180; and the latter from 1-300 to 600 in other specimens of wild birds.

PLATES.

¶ The Spleens, reduced to the under-mentioned proportions, are seen in Plate 2, fig. 160. Redbacked Shrike, ½.—161. Blackbird ¼.—162. Flycatcher, *(n.s.)*—163. Scarlet Tanager, ½.—164. Mocking Bird, ½.—165. Swallow, ½.—166. Night Jar, ½.—167. Sparrow, ½.—168. Grosbeak, ½.—169. Hawfinch, ½.—170. Blackheaded Manakin, ½.—171. Wren, *(n.s.)*—172. Yellow Wagtail, ½.—173. Raven, ¼.—174. Indian Hunting Crow, ¼.—175. Rice Bunting, ½—176. Starling, ¼.—177. Virginian Nightingale, ½.—178. Hoopoe, ½.—179. King Fisher, ½.

In the original drawings, the Spleens of 43 passerine birds are depicted; but I have considerably reduced the number, and added those of rarer birds since dissected.

SCANSORES.

The Spleens of these birds bear a great resemblance in form to those of the *Accipitres*, to some of which, as regards their general structure, they are nearly allied; the situation of the organ is, for the most part, the same as in the rapacious birds; but in the woodpecker *(Picus major)* its seat is upon the proventriculus, and not in contact with the gizzard, judging from only one specimen. As regards structure, there appears to be no peculiarity about the

Spleen of the climbing birds. Respecting the comparative weight of the Spleen in this division, no correct estimate can be formed from the small number of birds examined (13); and these, with one exception (woodpecker) in confinement. On referring to the table, it will be perceived that the proportionate weight of the Spleen varies from $\frac{1}{1660}$ (Maccaw) to $\frac{1}{3520}$. The weight of the viscera, in the subjoined table, is in grains.

1. Spotted Cuckoo. (*C. glandarius, Europe*). Some time in confinement; tubercles in the Spleen and lungs; B. $5\frac{1}{2}$, ozs.; S. 13 $\frac{1}{186}$; L. $380\frac{1}{6}$; K. 15 $\frac{1}{161}$; H. 20 $\frac{1}{121}$; Lgs. 19 $\frac{1}{127}$; A. C. 24 $\frac{1}{2}$ ins.

2. Green Woodpecker. (*P. viridis, Europe*). (Shot). B. 4 ozs.; S. $1\frac{1}{2}$ $\frac{1}{1173}$; L. 70 $\frac{1}{25}$; K. 14 $\frac{1}{125}$; H. 30 $\frac{1}{62}$; Lgs. 28 $\frac{1}{38}$; A. C. 20 ins.

3. Grey Parrot. (*P. erithecus, Africa*). A few tubercles in the right lung; B. 10 ozs. 105 grs.; S. $2\frac{1}{2}$ $\frac{1}{1802}$; L. 201 $\frac{1}{22}$; H. 102 $\frac{1}{44}$; Lgs. 100 $\frac{1}{45}$; A. C. 42 ins.

4. No. 2. *Pericarditis;* recent lymph on the heart; water in the *pericardium*; B. 10 ozs.; S. 4 $\frac{1}{1100}$; L. 235 $\frac{1}{18}$; K. 41 $\frac{1}{107}$; H. 100 $\frac{1}{44}$; Lgs. 105 $\frac{1}{41}$; A. C. 44 ins.

5. No. 3. C. D. *Pneumonia;* B. $8\frac{1}{2}$ ozs. (thin); S. 1 $\frac{1}{3740}$; L. 94 $\frac{1}{39}$; P. $1\frac{1}{4}$ $\frac{1}{2992}$; K. 20 $\frac{1}{187}$; H. 66 $\frac{1}{56}$; Lgs. 70 $\frac{1}{53}$; A. C. 24 ins.

6. King Parrot. (*Aprosmictus scapulatus, N. S. Wales*); B. $4\frac{1}{2}$ ozs.; S. $1\frac{1}{2}$ $\frac{1}{1320}$; L. 65 $\frac{1}{30}$; K. 12 $\frac{1}{165}$; H. 25 $\frac{1}{79}$; Lgs. 26 $\frac{1}{76}$; A. C. 44 inches.

7. Scarlet Maccaw. (*Macrocercus macao, S. America*). Liver soft, Spleen whitish; B. 2 lbs. 4 ozs.; S. about 24 grs. $\frac{1}{660}$; L. 615 $\frac{1}{25}$; P. 18 $\frac{1}{880}$; K. 40 $\frac{1}{396}$; H. 140 $\frac{1}{113}$; Lgs. 122 $\frac{1}{129}$; A. C. 63 inches.

8. Lory. (*Lorius, Asia, —— ?*); B. $3\frac{1}{2}$ ozs.; S. 2 $\frac{1}{990}$.—9. African Parroquet. (*Palæornis*); B. 2 ozs. 240 grs.; S. about 2 $\frac{1}{560}$.—10. Australian Parroquet, $3\frac{1}{2}$ ozs ; S. 1 $\frac{1}{1540}$.—11. Undulated Parroquet; about 3 ozs.; S. 1 $\frac{1}{1320}$.—12. Parroquet, ——?; B. 1 oz. 420 grs.; S. $1\frac{1}{2}$ $\frac{1}{540}$.—13. Parroquet, ——?; B. 1 oz. 60 grs.; S. $\frac{2}{3}$ $\frac{1}{750}$.

I did not ascertain the names of the last six-mentioned birds; they were all in good condition.

¶ I have since examined many other species of the *Scansores*, but the weight of the Spleen in proportion to the body is only given, although I have the weights of the viscera, and the length of the Alimentary Canal of all; but there is no important difference between these and the above described. The Woodpeckers and Cuckoos, it should be recollected, are almost, if not exclusively, insectivorous, whilst all the other birds named, are fruit and vegetable feeders.

14. Java Cuckoo. (*C. orientalis.*) 1,100.—15. Common Cuckoo. (*C. canorus, Europe.*) (Young;) 7,320.—16. No. 3. Adult; 1,180.—17. Green Woodpecker,

No. 2. 1,146.—18. Toucan. (*R. Toco, Brazil.*) Spleen tuberculated, weight 65 grs. 1-121; liver enlarged, but not tuberculated.—19. Red-breasted Toucan. (*R. dicolorus, Brazil.*) Spleen enlarged, 10 grs. 1-216; liver tuberculated.—20. Green Parrot. (*P. cyanotis, Brazil.*) 1,173.—21. Grey Parrot; 3,544.—22. Another species; 6,600.—23. Red vented Cockatoo. (*C. minor, Philli-pine Islands.*) 1,980.—24. Yellow-faced Conure. (*C. pertinax, Brazil.*) 2,000—25. Bonneted Psittacule. (*P. pileatus*) .2,640.—26. Ring-necked Parroquet. (*P torquatus N Africa.*) 375.—27. Rose Hill Parroquet. (*P eximius, N, Holland*). 754.—28. Le Vaillant's Parroquet. (*P. Le Vaillantii, Africa.*) 715.—30. Blood-rumped Parroqnet ——? 4,572.—31. *Palæornis Annulatus*, (*N. Africa.*) 375.—32. Blue mountain Lorikeet. (*Trichoglossus.*) 1,650.—33. Purple-capped Lory. (*L. domicellus.*) Spleen enlarged, 15 grs. 1-132.—34. Love bird. (*P. pullaria, W. Africa.*) 1,200.—35. Touraco. (*Corythaix Persa, Africa.*) 2,346. In two others examined, the Spleen and liver were studded with small, hard stellate tubercles, the Spleen in one 11 grs. 1-320; in the other it weighed 6 grs. 1-513. All the above birds, with the exception of the two common Cuckoos and the Woodpecker, had been in confinement.

AVERAGES.

¶ It is difficult, as I have before said, to give correct averagesin this class, the Spleen of many of the specimens being diseased and enlarged; but selecting from the first Table the Woodpecker, Grey Parrot, and King Lory, all in good condition, the average proportion of the viscera to the body, is S. 1,431; L. 25; K. 145; H. 60; Lgs. 61.

PLATES.

¶ The Spleens, reduced in size as described below, are shown in Plate 2, Fig. 180.—Green Woodpecker, ½.—181. Common Cuckoo, ½.—182. Java Cuckoo, ½.—183. Australian Cuckoo, ½.—184. Toucan, ¼.—185. Touraco, ¼.—186. King Parrot, ½.—187. Grey Parrot, ½.—188. Scarlet Maccaw, ⅓.—189. Green Parrot, ½.—190. Cockatoo, ⅓.—191. Australian Parroquet, ½.—192. Undulated Parroquet, (*n. s.*)—193 and 194. ½, (species unknown.)—195. Blue Mountain Parroquet, ½.—196. Yellow-faced Conure, (*n. s*).—197. Pileated Parroquet, ½.—198. Ring Parroquet, ½.—199. Rose Hill Parroquet, ½.—200. Le Vaillant's Parroquet, ¼.—201. Purple-capped Lory, ½.—202 Lorikeet, ½.—203. Love Bird, (*n. s*).

GALLINÆ.

The Spleen in this division of Birds is generally larger than in any other. In the common cock, five years old, it was very large; and the artery, vein, and nerve, were proportionately so. The Spleen in all the gallinaceous birds that I have seen is roundish or heart-shaped. The Malpighian corpuscles are better seen in this division of birds than in any other; and I *think* the vessels and nerves are comparatively larger.

In the remaining structures, there is no difference in this class and the others; the Spleens of all birds, as regards their minute structure, bearing a great similitude.

The weight of the viscera in this, as in all the tables of the Birds, is in grains.

1. Globose Curassow. (*Crax, globicera, S. America*). *Pericarditis* (recent); Spleen, liver, and kidneys tuberculated; lungs mouldy; B. thin, 3½ lbs.; S. 38 $\frac{1}{648}$; L. 1,540 $\frac{1}{16}$; P. 14 $\frac{1}{1760}$; K. 170 $\frac{1}{144}$; H. 360 $\frac{1}{68}$; Lgs. 270 $\frac{1}{91}$.

2. Albert's Curassow. (*C. Alberti, S. America*). Tubercles in lungs and in the edges of the liver; Spleen not tuberculated; Pancreas enlarged; B. 4 lbs 4 ozs.; S. 33 $\frac{1}{906}$; L. 1,330 $\frac{1}{22}$; P. 220 $\frac{1}{142}$; K. 145 $\frac{1}{206}$; H. 172 $\frac{1}{173}$; A. C. 11 ft. 2 inches.

3. Guan. (*Penelope pileata, S. America*). Tubercles in liver and Spleen; a few in the lungs; one in the kidney. B. 17 ozs.; S. 80 $\frac{1}{93}$; L. 380 $\frac{1}{19}$; P. 10 $\frac{1}{748}$; H. 129 $\frac{1}{57}$; A. C. 5 ft. 2 ins.—4. No. 2. Spleen, liver, and lungs tuberculated. B. 2½ lbs.; S. 50 $\frac{1}{352}$.—5. No. 3. Tubercles in liver, Spleen, and intestines; lungs sound. B. 2 lbs. 8 ozs.; S. 40 $\frac{1}{440}$; L. 915 $\frac{1}{19}$; K. 40 $\frac{1}{440}$.

6. Tinamou. (*T. rufescens, S. America*). B. 20 ozs. (thin); S. 5 $\frac{1}{1760}$; L. 200 $\frac{1}{44}$; P. 4 $\frac{1}{2200}$; K. 23 $\frac{1}{382}$; H. 80 $\frac{1}{100}$; Lgs. 82 $\frac{1}{97}$; A. C. 4 ft. 4 inches.

7. Pea Fowl; bled to death. B. 8 lbs. 4 ozs.; S. 23 $\frac{1}{2525}$; L. 445 $\frac{1}{130}$; H. 410 $\frac{1}{141}$.

8. No. 2; died in confinement; very fat. B. 9 lbs.; S. 1760 $\frac{1}{36}$; L. 3080 $\frac{1}{20}$; K. 220 $\frac{1}{288}$; H. 660 $\frac{1}{96}$; Lgs. 240 $\frac{1}{264}$.

9. Pheasant. (*P. Colchicus, Europe*). (Shot.) B. 2 lbs. 15 ozs.; S. 10 $\frac{1}{2068}$; L. 303 $\frac{1}{68}$; K. 30 $\frac{1}{689}$ (so entered); H. 80 $\frac{1}{258}$; Lgs. 60 $\frac{1}{344}$; A. C. 6 ft. 2 ins.

10. No. 2. Mule. B. 26 ozs. (thin); S. 3 $\frac{1}{3813}$; L. 337 $\frac{1}{30}$; A. C. 7 ft. 11 ins.

11. Golden Pheasant. (*P. pictus, China*). B. 12 ozs. (thin); S. 2 $\frac{1}{2640}$; L. 199 $\frac{1}{26}$; P. 2 $\frac{1}{2640}$; K. 30 $\frac{1}{176}$; H. 69 $\frac{1}{76}$; Lgs. 65 $\frac{1}{81}$; A. C. 4 ft. 4 ins.

12. Ring-necked Pheasant. (*P. torquatus, Asia*). B. 15 ozs.; S. 2 $\frac{1}{3300}$; L. 210 $\frac{1}{98}$; P. 10 $\frac{1}{660}$; K. 39 $\frac{1}{169}$; H. 46 $\frac{1}{143}$; Lgs. 70 $\frac{1}{94}$; A. C. 4 ft. 10 ins.

13. Capercailzie. (*T. urogallus, Europe*). B. 9 lbs. 4 ozs.; S. about 25 $\frac{1}{2604}$; L. 660 $\frac{1}{98}$; H. 540 $\frac{1}{120}$; Lgs. 442 $\frac{1}{147}$; A. C. 17 ft. 2 ins.

14. Ptarmigan. (*Lagopus mutus, Europe*). B. 17 ozs.; S. about 3 $\frac{1}{2493}$; L. 89 $\frac{1}{84}$; A. C. 6 ft. 1 in. These last two birds had been packed in ice.

15. Common Partridge. (*P. cinerea*). B. 16 ozs.; S. 2 $\frac{1}{3320}$; L. 117 $\frac{1}{60}$; A. C. 3 ft. 10 ins.

16. African Partridge, *(P. petrosa)*. In confinement; ulceration of the cœcal appendices. B. about 10 ozs.; S. 61 $\frac{1}{130}$; L. 440 $\frac{1}{10}$; P. small; K. 52 $\frac{1}{84}$; H. 61 $\frac{1}{72}$; Lgs. 63 $\frac{1}{69}$; A. C. 5 ft. 3 ins.

17. Guinea Fowl. *(Numida meleagris)*. Domesticated; bled; B. 3½ lbs.; S. 12 $\frac{1}{1053}$; A. C. 7 ft. 10 ins.—18. No. 2. From Africa. *(N. eristata)*. Tubercles in lungs, Spleen, and liver. B. 12 ozs.; S. 50 $\frac{1}{217}$; L. 520 $\frac{1}{12}$; P. 51 $\frac{1}{724}$; H. 400 $\frac{1}{92}$; Lgs. 280 $\frac{1}{132}$; A. C 7 ft. 7 ins.

19. Cock. *(P. gallus)*. Five years old; killed by another cock. B. 5 lbs. 4 ozs.; S. 170 $\frac{1}{217}$; L. 1,320 $\frac{1}{28}$; P. 51 $\frac{1}{724}$; K. 400 $\frac{1}{92}$; H. 280 $\frac{1}{132}$; A. C. 7 ft. 10 ins.

20. No. 2. Young Cock. (Bled.) B. 2 lbs. 11 ozs.; S. 18 grs. $\frac{1}{1051}$; L. 415 $\frac{1}{45}$; H. 150 $\frac{1}{126}$; Lgs. 145 $\frac{1}{130}$; A. C. 7 ft. 4 ins.

Young Birds.—21. Chicken (hatched 24 hours). B. 225 grs.; S. about ¼ $\frac{1}{900}$; L. 9 $\frac{1}{25}$; K. 1 $\frac{1}{225}$; H. 2¼ $\frac{1}{200}$; Lgs. 20½ $\frac{1}{10}$; A. C. 20½ ins.—22. No. 2. Hatched several days. B. 508 grs.; S. about ⅓ $\frac{1}{1524}$; L. 17 $\frac{1}{29}$; H. 5 $\frac{1}{101}$; Lgs. 20 $\frac{1}{25}$. These chickens were found dead.

Pigeons.—23. Crowned Pigeon. *(Goura coronata, India)*. 8 ozs. of clear fluid in the chest; *Periearditis* also. B. 2 lbs. 12 ozs.; S. 25 $\frac{1}{774}$; L. 1,100 $\frac{1}{17}$; P. 25 $\frac{1}{774}$; K. 100 $\frac{1}{193}$; H. 135 $\frac{1}{143}$; Lgs. 150 $\frac{1}{129}$; A. C. 6 ft. 3 in.

24. Fruit-eating Pigeon. *(Carcophaga Œnea, India)*. B. 6½ ozs.; S. 1 $\frac{1}{2860}$; L. 90 $\frac{1}{32}$; H. 33 $\frac{1}{86}$; Lgs. 43 $\frac{1}{66}$; A. C. 2 ft. 9 ins.

25. Passenger Pigeon. (*Eetropistes migratoria, Ameriea*). B. 9 ozs.; S. 5 $\frac{1}{752}$; A. C. 2 ft. 3 inches.

26. Mountain Witch Dove. (—— *?*). B. 7 ozs.; S. ⅔ $\frac{1}{4620}$; L. 100 $\frac{1}{30}$; K. 14 $\frac{1}{220}$; H. 22 $\frac{1}{140}$; Lgs. 26 $\frac{1}{118}$; A. C. 5 ft. 7 ins.

27. Wood Pigeon. (*C. palumbus, Europe*). (Shot). B. 16 ½ ozs.; S. 1½ $\frac{1}{4840}$; L. 200 $\frac{1}{31}$; K. 105 $\frac{1}{69}$; Lgs. 90 $\frac{1}{80}$; A. C. 9 ft. 7 ins.

¶ The birds of this order since examined are the following; the proportion of the Spleen, and occasionally of the other viscera, to the body, is only given.

28. Yarrell's *Curassow. (C. Yarrellii, S. America)*. 1,760.—29. Barred Curassow. *(C. fasciata, S. America)*. 3,000—30. Horsefield's Pheasant. *(—— ? India)*. S. 1,466; L. 46; P. 1,466; K. 363; H. 200; Lgs. 176; A. C. 5 ft 1 in.—31. Ring-necked Pheasant. No. 2. Spleen and liver tuberculated. S. 132.—32. Silver Pheasant. *(P. lineatus, China)*. 1,100.—33. Impeyan Pheasant. *(P. Impeyanus, Himalaya Mountains)*. 1,800.—34. Common Pheasant, (specimens 2 and 3), 4,400, 3,800.—35. Old mule Hen, with the plumage of the cock. S. 572.—36. Common Grey Partridge. No. 2. 1,906.—37. Hardwick's Partridge. *(——? India)* S. enlarged, 472.—38. Pinnated Grouse. *(Tetrao Cupido, America)*. S. 2,346; L. 35;

K. 207; H. 67; Lgs. 70; A. C. 9 ft. 1 in.—39. Red Grouse. *(T. Scoticus)*. 6,166.—40. Black Cock. *(T. tetrix, Europe)*. 1,848.—41. Common Quail. *(T. coturnix, Europe)*. (Two specimens). 3,520, 1,900.—42. Andalusian Quail. 1,760.—43. Common Turkey. *(M. gallipavo)*. 2,514.—44. Guinea Fowl. No. 2. (bled). S. 303.—45. Cochin China Cock. (Two specimens.) 937, 797. 46. Spanish Cock. 920.—47. Old mule Hen. 355.

Pigeons.—48. Crowned Pigeon. No. 2. 924.—49. Fruit-eating Pigeon. No. 2. 1,584.—50. Naked-eyed Pigeon. *(C. gymnopthalmos, West Indies)*. 4,400.—51. Turtle Dove. *(C Turtur)*. (Shot.) (Three specimens), 1,183, 1,466, 2,520.—52. Stock Dove. *(C. œnas, Europe)*. (Two specimens), 3,520, 2,530.—53. Wood-pigeon. *(C. palumbus)*. (Eight specimens), 2,786, 4,400, 2,224, 6,100, 4,693, 2,200, 666, 660.

AVERAGES.

¶ The statement above, that the Spleen is generally larger in this order of birds than in any other, is scarcely correct, as shewn by the above averages. In making this remark, I was influenced by the examination of the Cock (No. 19), which had the Spleen apparently normal in structure; and for reasons before stated I had not time to make the general averages. The average weight of the following viscera to the body, in the young Cock, Ring-necked Pheasant, Golden Pheasant, Capercailzie, and Pinnated Grouse, is—S. 2,388; L 47; P. 1,650; K. 184; H. 106; Lgs. 104. For the Pigeons the reader must examine the tables.

PLATES.

¶ Plate 2. The size of the Spleens reduced to the undermentioned proportions. Fig. 205. Peacock, $\frac{1}{6}$ A.—206. Common Pheasant, $\frac{1}{4}$.—Torquatus, $\frac{1}{2}$.—208. Golden Pheasant, $\frac{1}{2}$.—208 A. Silver Pheasant, $\frac{1}{2}$.—209. Horsefield's Pheasant, $\frac{1}{2}$.—210. Impeyan Pheasant, $\frac{1}{2}$.—211. Japan Pheasant. (*Versicolor*). $\frac{1}{2}$.—212. Turkey, 1 5.—213. Guinea Fowl, $\frac{1}{2}$.—214. Cock, $\frac{1}{3}$.—215. Capercailzie, $\frac{1}{4}$.—216. Red Grouse, $\frac{1}{2}$.—217. Black Cock, $\frac{1}{4}$.—218. Pinnated Grouse, $\frac{1}{2}$.—219. African Partridge, $\frac{1}{2}$.—220. Grey Partridge, $\frac{1}{2}$.—222. Tinamou, $\frac{1}{3}$.—223. Andalusian Quail (*n. s.*).—224. Common Quail (*n. s.*).—*Pigeons.*—225. Wood-pigeon, $\frac{1}{3}$.—226. Passenger Pigeon, $\frac{1}{4}$.—227. Fruit-eating Pigeon, $\frac{1}{2}$.—228. Naked-eyed Pigeon, $\frac{1}{2}$.—229. Crested Pigeon, $\frac{1}{2}$.—230. Crown Pigeon, $\frac{1}{4}$.—231. Mountain Witch Dove, $\frac{1}{2}$.—232. Turtle Dove, $\frac{1}{2}$.—Stock Dove, $\frac{1}{2}$.—Nutmeg Pigeon. (*C. myristicivora, India*). $\frac{1}{2}$.

GRALLÆ.

In the Waders, the Spleen is seated, as in the other birds, between the cardiac and pyloric openings; in some, (Herons and thick-knees), upon the extremity of the œsophagus. The form, as will be seen by referring to the Plates, is generally round or oblong. In the Weka Rail (New Zealand) it is more like that of a passerine bird.

The splenic artery is unusually large in the Cranes and in the Bustard, but the nerves are small. The Malpighian bodies, as in all the birds, are less distinct than in Mammals, but in some, however, they are very prominent (Herons, *e. g.*) As regards

minute structure, there is nothing peculiar in this class. For Spleen-pulp see Plates E, *(Gallinæ)*.

Comparative Weight.—Taking the common Heron, (Prep. 89.) the Wattled Crane, and Lapwing, as examples, all these birds being in good condition, the weight of the Spleen, as compared with that of the body, is in the Lapwing, 1 to 3,080; Crane, 1 to 1,793; Heron, 1 to 2,053.

The weight of the viscera in the following is in grains, when *ozs.* are not named.

1. Great Bustard. *(Otis tarda, Europe).* B. 6 lbs.; S. 90 $\frac{1}{469}$ (See other specimens below).

2. Spurred Plover. *(S. limosa, Africa).* Tubercles in lungs, liver, and spleen; B. 5 ozs.; S. $1\frac{3}{4}$ $\frac{1}{1257}$; L. 145 $\frac{1}{15}$; K. 15 $\frac{1}{146}$; H. 25 $\frac{1}{88}$; A. C. 24 ins.

3. Golden Plover. *(C. pluvialis, Europe).* (Shot). B. $6\frac{1}{2}$; S. 2 $\frac{1}{1430}$; L. 107 $\frac{1}{26}$; H. 35 $\frac{1}{81}$; A. C. 27 ins.—4. No. 2. In confinement; B. 4 ozs.; S. $1\frac{1}{2}$ $\frac{1}{1173}$; L. 95 $\frac{1}{18}$; K. 15 $\frac{1}{117}$; H. 30 $\frac{1}{58}$; Lgs. 32 $\frac{1}{55}$; A. C. 35 ins.

5. Lapwing. *(Tringa vanellus, Europe).* (Shot). B. 7 ozs.; S. 1 $\frac{1}{3080}$; L. 100 $\frac{1}{30}$; H. 40 $\frac{1}{77}$; Lgs. 45 $\frac{1}{68}$; A. C. 27 ins.

6. *(——? Europe).* Fatty liver; B. 11 ozs. (thin); S. $1\frac{1}{2}$ $\frac{1}{3226}$; L. 165 $\frac{1}{29}$; K. about 12 $\frac{1}{403}$; H. 55 $\frac{1}{88}$; Lgs. 43 $\frac{1}{112}$; A. C. 28 ins. This bird is called a Thick-knee in the table, but probably it was another species of Plover.

7. Thick-knee. *(Œdicnemus crepitans).* Kidneys large and soft; B. 20 ozs.; S. 14 $\frac{1}{628}$; L. 280 $\frac{1}{31}$ K. 52 $\frac{1}{169}$; H. 160 $\frac{1}{55}$; Lgs. 140 $\frac{1}{62}$; A. C. 42 ins.

8. Oyster-Catcher. *(H. ostralegus, Europe).* Old peritonitis; tubercles in liver and right kidney; B. 12 ozs. (thin); S. 4 $\frac{1}{1320}$; L. 135 $\frac{1}{39}$; H. 52 $\frac{1}{101}$; A. C. 46 ins.

9. Wattled Crane. *(Grus carunculata, S. Africa).* *Pneumonia*; a pin in the peritoneal cavity; B. $13\frac{1}{2}$ lbs.; S. 53 $\frac{1}{1793}$; L. $5\frac{1}{2}$ ozs. $\frac{1}{39}$; K. 380 $\frac{1}{250}$; H. 2 ozs. 340 grs. $\frac{1}{77}$; Lgs. $3\frac{1}{2}$ $\frac{1}{61}$; A. C. 12 ft. 3 ins.

10. Common Crane *(Grus cinerea, Europe).* Hydrothorax, enlarged liver and Spleen. B. (thin) $6\frac{1}{2}$ lbs.; S. 400 $\frac{1}{114}$; L. $18\frac{1}{2}$ ozs. $5\frac{1}{2}$; P. 100 $\frac{1}{457}$; K. 320 $\frac{1}{143}$; H. 366 $\frac{1}{125}$; Lgs. 750 $\frac{1}{60}$; A. C. 11 ft. 4 ins.

11. Native Companion Crane. *(G. Australasianus, Australia).* Tubercles in the liver and Spleen, and enlarged mesenteric glands. B. (thin) 4 lbs.; S. 118 $\frac{1}{238}$; L. 2,520 $\frac{1}{11}$; P. 16 $\frac{1}{1760}$; K. 150 $\frac{1}{187}$; H. 560 $\frac{1}{50}$; Lgs. 880 $\frac{1}{32}$; A. C. 9 ft. 5 inches.

12. Crowned Crane. *(Ardea pavonia, W. Africa)* Tubercles in Spleen and liver. B. (thin) 5 lbs. 7 ozs.; S. 55 $\frac{1}{593}$; L. 1,100 $\frac{1}{34}$; P. 83 $\frac{1}{461}$; K. 150 $\frac{1}{235}$; H. 140 $\frac{1}{273}$; Lgs. 370 $\frac{1}{103}$; A. C. 9 ft. 7 ins.

13. Stanley Crane. *(A. paradisea, S. Africa)*. Tubercles in lungs, liver, and Spleen. B. 2 lbs. (very thin); S. 135 $\frac{1}{104}$; P. 95 $\frac{1}{148}$; H. 570 $\frac{1}{24}$; A. C. 8 ft. 2 inches.

14. No. 2. B. (thin) 5 lbs. 11 ozs.; S. about 90 $\frac{1}{444}$; L. 1,350 $\frac{1}{29}$; P. 90 $\frac{1}{444}$; K. 360 $\frac{1}{111}$; A. C. 8 ft. 9 inches.

15. Common Heron. *(Ardea cinerea, Europe)*. (Shot). B. 3½ lbs.; S. 12 $\frac{1}{2053}$; L. 620 $\frac{1}{39}$; K. 85 $\frac{1}{289}$.; H. 180 $\frac{1}{136}$; Lgs. 320 $\frac{1}{77}$; A. C. 9 ft. 6 ins.—16. No. 2, in confinement; bad food; thin. B. 31 ozs.; S. 18 grs. $\frac{1}{757}$.

17. Purple Heron. *(A. purpurea, Europe)*; bad food; very thin. B. 24 ozs.; S. about 10 $\frac{1}{1056}$; Lgs. 365 $\frac{1}{28}$; K. 80 $\frac{1}{132}$; H. 111 $\frac{1}{95}$; Lgs. 110 $\frac{1}{96}$; A. C. 7 ft. 6 inches.

18. Scarlet Ibis. *(Ibis rubra, S. America)*. Killed by its companion. B. about 9 ozs.; S. 4 $\frac{1}{990}$; L. 210 $\frac{1}{18}$; P. 5 $\frac{1}{792}$; K. 32 $\frac{1}{123}$; H. 78 $\frac{1}{50}$; Lgs. 29 $\frac{1}{136}$; A. C. 3 ft. 6 inches.

19. Godwit. *(Limosa Ægocephala, Europe)*. (Shot.) B. 12½ ozs.; S. 3 $\frac{1}{1833}$; L. 285 $\frac{1}{19}$; H. 81 $\frac{1}{67}$; Lgs. 80 $\frac{1}{68}$; A. C. 2 ft. 10 ins.

20. Avoset. *(A. recurvirostra, Europe)*.—In confinement. B. 8 ozs.; S. 2 $\frac{1}{1760}$; L. 95 $\frac{1}{37}$; Lgs. 42 $\frac{1}{83}$; A. C. 3 ft. 10 inches.

21. Reeve. *(Tringa pugnax, Europe)*. (Shot). B. 6 ozs.; S. 1½ $\frac{1}{1760}$; L. 102 $\frac{1}{25}$; H. 58 $\frac{1}{45}$; Lgs. 62 $\frac{1}{42}$; A. C. 24½ inches.

22. Turnstone. *(Strepsilas interpres, Europe)*. (Shot). B. 3 ozs. 60 grs.; S. 1 $\frac{1}{1380}$; L. 55 $\frac{1}{25}$; H. 25 $\frac{1}{155}$; Lgs. 22 $\frac{1}{62}$; A. C. 19 ins.

23. Redshank. *(T. calidris, Europe)*. (Shot). B. 4 ozs.; S. ½ $\frac{1}{3520}$; L. 70 $\frac{1}{25}$; H. 25 $\frac{1}{140}$; Lgs. 45 $\frac{1}{72}$; A. C. 31 inches.

24. Weka Rail. *(Ocydromus Australis, New Zealand)*. B. about 16 ozs.; S. about 6 grs. $\frac{1}{1173}$; L. 360 $\frac{1}{19}$; K. 40 $\frac{1}{176}$; H. 50 $\frac{1}{140}$; Lgs. 61 $\frac{1}{115}$; A. C. 4 ft. 5 inches.

25. Coot. *(Fulica atra)*. (Shot). B. 24 ozs.; S. 9 $\frac{1}{1173}$; L. 280 $\frac{1}{37}$; K. 55 $\frac{1}{192}$; H. 135 $\frac{1}{78}$; Lgs. 130 $\frac{1}{81}$; A. C. 7 ft. 8 inches.

26. Moor Hen. *(Gallinula chloropus)*. (Shot). B. 1 oz.; S. 5 $\frac{1}{880}$. The weight of this specimen is described under the drawing of the Spleen.

¶ Many interesting additions have been made since the above named birds were dissected; the comparative weight of the Spleen to the body is, in most instances, only stated.

27. Great Bustard. No. 2. Male. B. 12 lbs.; S. 24 grs 1-3520.—28. No. 3. Female. B. 7 lbs. 12 ozs.; S. 52 grs. 1-1049; A. C. 8 ft. 3 ins.—29. American Ostrich. *(Rhea Americana)*. Young; bred in the Regent's Park

Gardens; broken leg; B. 9 lbs. 2 ozs.; comparative weight of the viscera to the body; S. 3059; L. 26; K. 229; H. 59; Lgs. 53; A. C. 11 ft. 11 ins.—30. No. 2. Old Rhea. Male. B. 34 lbs.; Spleen and Liver much enlarged and tuberculated; weight of the former 3 ozs. 40 grs., of the latter 3 lbs. 9 ozs; A. C. 13 ft. 11 ins.; the cœcal appendices 60 inches.—Common Crane No. 2. B. 6 lbs.; S. 15 1-2816. 31. White Stork. (*C. alba, Europe*). 9856. 32. Little Egret. (*A. Garzetta, Europe*). 3080.—33. Buff-backed Egret (——?) 2640.—34. Sacred Ibis. (*I. religiosa, Africa*). B. 2 lbs. 13 ozs.; S. tuberculated, weight 273 grs.; L. sound.—35. Bittern. (*B. stellaris, Europe.*) S. 960; L 41.—36. Common Heron. No. 2. (Shot.) 2200.—37. Curlew. (*Numenius arquata, Europe*). (Shot.) 2480.—38. White Spoonbill. (*Platalea leucorodia, Europe*). B. 2 lbs. 13 ozs.; S. 14 1-1414.—39. Jabiru. (*Mycteria Americana*). B 17½ lbs.; S. 60 1-2082.—40. Marabou Stork. (*Leptoptilus crumeniferus, W. Africa*). Young. B. 7½ lbs.; S. 32 1-1650.—41. Secretary Vulture. (*Gypogeranus serpentarius.*) B. 7 lbs. 14 ozs.; S. 25 1-2213. This bird would have been better placed with the *Falconidæ*, perhaps?—42. Red Shank. No. 2. (Shot.) 4480.—43. Ruff. No. 2. (Shot.) 2220.—44. Avocet. No. 2. (Shot.) 1960.—45. Snipe. (*Sc. gallinago, Europe*). Two specimens, (Shot,) 5760, 5940.—46. Jack Snipe. (*S. gallinula*). (Shot.) 3650.—47. Common Sandpiper. (*T. Hypoleucos, Europe*). (Shot.) 4075.—48. Green Sandpiper. (*T. ochropus*). 2112.—49. Little Sandpiper. (*T. minuta*). (Shot.) 2010.—50. Rail ——? (*New Zealand.*) 1320.—51. Water Rail. (*Rallus aquaticus, Europe*). Two specimens, (Shot,) 557, 1626—52. Land Rail. (*Crex pratensis, Europe*). (Shot.) 1833.—53. Lapwing. (*Venellus cristatus, Europe*). Six specimens, (Shot,) 2090, 2622, 3280, 3740, 1967, 2510.—54. Coot. (*Fulica atra, Europe*). Four specimens, (Shot,) 1174, 1613, 344, 310.—55. Purple Gallinule. (*G. hyacinthinus, Africa*) 1760.—Moor Hen. (*G. chloropus, Europe*). Twelve specimens, (Shot,) 1115, 1199, 806, 1101, 860, 528, 1144, 1601, 1375, 2090, 1768, 2060; 1980. The last four specimens were shot in December, during severe cold; their bodies fat.

AVERAGES.

¶ As might be inferred from the comparative weights of the Spleen, already stated, of the Wattled Crane, Heron, and Lapwing, the Spleen of the birds of this order is of small size. Many of the specimens were living in a state of nature, and therefore the inferences are more valuable. The average proportion of the viscera of the three birds above named is, S. 2308; L. 36; K. 179; H. 96; Lgs. 68.

PLATES.

¶ Plate 2, Fig. 239. Common Crane, ⅛.—240. Wattled Crane, ⅛.—241. Stanley Crane, ⅙.—242. White Stork, ½.—243. Spoonbill, ½.—244. Jabiru, ½.—245. Marabou, ⅓.—246. Common Heron, ¼.—247. Purple Heron, ½.—248. Scarlet Ibis, ½.—249. Sacred Ibis, ½.—250. Egret. ½.—251. Turnstone, ½.—252. Spurred Plover, ½.—255. Red Shank, ½.—256. Avoset ½.—257. Oyster-eater. ½.—258, Godwit, ½.—259. Reeve, ½.—260. Moor Hen, ⅓.—261. African Moor Hen, ⅓.—262. Bittern, ½.—263. Weka Rail, ½.—265. Water Rail, ½.—266. Land Rail, ½.—267. Common Sandpiper, (*n. s.*)—268. Little Sandpiper, (*n. s.*)—269. Green Sandpiper, (*n. s.*)—270—Woodcock ½.—271 Snipe, (*n. s.*)—272 Secretary Vulture, ½.—235. American Ostrich, (young,) ⅓.—236. African Ostrich.—$\frac{1}{10}$.—237. Great Bustard, ½.—238. Apteryx, ½.

PALMIPEDES.

The Birds of this division have the Spleen varying in its situation according to the character of the stomach, thus in the ducks,

swans, teal, and widgeon, it is placed on the right and lower part of the proventriculus, but in the pelican, (one examined,) a bird with a stomach that resembles somewhat that of a fish, or reptile, the Spleen is seated upon this organ. In the gulls, and in the gannet, it is placed below, and to the right of the cardiac opening. The form of the organ is likewise different in the *Palmipedes;* thus in the ducks, swans, geese, teal, and widgeon, it is somewhat heart-shaped, whilst in the gulls it assumes more of a cylindrical form; in the gannet and pelican it is more oblong.

The Table comprises only 18 of the webb-footed birds. The weight of the viscera is in grains.

1. Pelican. *(P. crispus, Africa).* Dropsy of *Pericardium,* and diseased kidneys, (see Plate 1 E, *Palmipedes.*) B. 11 lbs.; S. 39 $\frac{1}{1980}$; L. 6 ozs. $\frac{1}{16}$; P. 100 $\frac{1}{774}$; K. 780 $\frac{1}{99}$; H. 1,280 $\frac{1}{60}$; A. C. 12 ft. 8 ins.

2. Gannet. *(Sula Bassana, Europe).* Ureters plugged with urate of *ammonia.* B. 5 lbs. 4 ozs.; S. about 20 $\frac{1}{1848}$; L. 1,790 $\frac{1}{20}$; K. 443 $\frac{1}{83}$; H. 380 $\frac{1}{97}$; Lgs. 240 $\frac{1}{154}$; A. C. 6 ft. 6 ins.—3. No. 2. 4 lbs., 3 ozs.; S. 15 $\frac{1}{1965}$.

4. Common Duck. *(Anas).* (Bled.) B. $3\frac{3}{4}$ lbs.; S. 10 $\frac{1}{2640}$.—5. No. 2. Common Drake. (Bled.) B. $4\frac{1}{2}$ lbs.; S. 12 $\frac{1}{2640}$; L. 845 $\frac{1}{37}$; H. 216 $\frac{1}{146}$; Lgs. 220 $\frac{1}{144}$; A. C. 9 ft. 3 ins.

6. Wild Duck. *(A. boschas).* (Neck broken.) B. 2lbs. 14 ozs.; S. 6 $\frac{1}{3373}$; L. 570 $\frac{1}{35}$; K. 30 $\frac{1}{674}$; H. 190 $\frac{1}{106}$; Lgs. 175 $\frac{1}{115}$; A. C. 7 ft. 2 ins.—7. No. 2. B. 3 lbs.; S. 5 $\frac{1}{4224}$.

¶ The intestinal canal of most animals is increased in length by domestication and change of food. See also pigs, rabbits, and cats.—*After note.*

8. Mandarin Duck. *(Aix galericulata, China).* Tubercles in Spleen and lungs; liver full of hydatids. B. 14 ozs.; S. 30 $\frac{1}{205}$; L 1,100 1-$5\frac{1}{2}$; K. 11 $\frac{1}{560}$; H. 91 $\frac{1}{67}$; Lgs. 120 $\frac{1}{57}$; A. C. 3 ft. 10 ins.—9. No. 2. (Young,) in good condition. B. 14 ozs. S. 5 $\frac{1}{1232}$.—10. No. 3. Old Drake. Tuberculated Spleen; enlarged liver. B. 17 ozs.; S. 34 $\frac{1}{220}$; L. 2,380 3 $\frac{1}{7}$; P. 4 $\frac{1}{1870}$; H. 56 $\frac{1}{133}$; Lgs. 95 $\frac{1}{78}$; A. C. 4 ft. 3 ins.

¶ These ducks, notwithstanding the enormous amount of disease, were in beautiful plumage.—*After note.*

11. Carolina Duck. *(Aix sponsa.)* Spleen tuberculated; liver black and pitchy. B. 16 ozs.; S. 15 $\frac{1}{469}$.

12. Yellow-billed Duck. *(A. flavirostris, S. Africa.)* B. about 12 ozs.; S. $5\frac{1}{2}$ $\frac{1}{960}$; L 280 $\frac{1}{18}$; H. 131 $\frac{1}{40}$; Lgs. 100 $\frac{1}{52}$; A. C. 3 ft.

13. Widgeon. *(A. Penelope, Europe.)* (Shot.) B. 23 ozs.; S. 2 $\frac{1}{5066}$; L. 220 $\frac{1}{46}$; A. C. 5 ft. 10 ins.

14. Teal. *(Q. crecca, Europe.)* (Shot.) B. 14 ozs.; S. 4 $\frac{1}{1540}$; L. 145 $\frac{1}{42}$; K. 14 $\frac{1}{440}$; H. 61 $\frac{1}{100}$; Lgs. 60 $\frac{1}{101}$; A. C. 7 ft. 5 ins.—15. No. 2. B. 13 ozs.; S. 3½ $\frac{1}{1634}$.

16. Skua Gull. *(L. Pomarinus, Europe.)* B. 2 lbs. 11 ozs.; S. 5 $\frac{1}{3784}$; L. 600 $\frac{1}{31}$; K. 55 $\frac{1}{344}$; H. 180 $\frac{1}{105}$; Lgs. 140 $\frac{1}{135}$; A. C. 3 ft. 6 ins.

17. Great Black-backed Gull. *(L. marinus, Europe.)* A large fish-hook in the crop, and the lung diseased from this cause. B. thin, 3 lbs. 1 oz.; S. 21 $\frac{1}{1036}$; L. 920 $\frac{1}{23}$; P. 27 $\frac{1}{798}$; H. 178 $\frac{1}{121}$; A. C. 4 ft. 5 ins.

18. Penguin. *(Aptenodytes. —?)* B. 2½ lbs.; S. about 14 qrs. $\frac{1}{1257}$. This specimen was in spirit (College collection).

¶ The subjoined Table includes many additions to the above; some of them especially interesting. The proportion of the viscera to the body is only given.

19. Mute Swan. *(C. olor, Europe).* B. 12½ lbs.; S. 1,725; L. 19; P. 440; K. 183; H. 66; Lgs. 48.—20. Blacknecked Swan. *(C. nigrocollis, S. America).* S. 3,748; L. 45; K. 112.—21. Sandwich Island Goose. *(Bernicula Sandvichensis).* 2,112.—22. Brent Goose. *(A. Brenta, Europe).* 4,048.—23. Ruddy Shell Duck. *(A. rutila, India).* 6,160.—24. Dusky Duck. *(A. obscura, N. America).* 3,520.—25. Whistling Duck. *(A. autumnalis, S. America).* 2,310.—26. Velvet Scouter. *(Oidemia fusca, Europe).* 2,346.—27. Shoveller. *(A. clypeata, Europe).*—28. Pintail *(A. acuta).* 3,645.—29. Summer Duck, No. 2, 1,760.—30. Mandarin Duck, aged three weeks, No. 3. 800.—No. 4. Two-thirds grown, 2,053.—31. Tame Ducks (six specimens), 1,508, 1,760, 1,320, 841, 719, 1,620.—32. Wild Duck (two specimens), 1,620, 4,106.—33. Widgeon, No. 2. 2,112.—34. Teal, No. 3, 3,080.—*Laridæ.*—35. Blackheaded Gull. *(L. fuscus).* 2,260.—36. Herring Gull. *(L. argentatus).* 1,320.—37. Kittiwake. *(L. rissa).* 2,970.—38. Common Gull. *(L. canus).* 2,640.—39. Common Tern. *(Sterna Hirundo)*, (two specimens), 5,000, 1800.—40. Cormorant. *(C. cormoranus)*, (two specimens), 2,332, 3,696.—41. Little Auk. *(Mergulus alle).* S. 2,840; L. 23; K. 101; H. 61; Lgs. 61.—42. Razor Bill. *(Alca torda).* S. 620; L. 20; K. 175; H. 80.—43. Manx Petrel. *(P. anglorum)*, (two specimens), 1,063, 1,026.—44. Foolish Guillemot. *(Uria troile).* 813.—45. Little Grebe. *(Podiceps minor).* S. 3,640; L. 13; P. 820; K. 76; H. 58; Lgs. 51.—46. No. 2. S. 1,511; L. 25.—47. Yellow-throated Diver. *(C. septentrionalis).* B. 4 lbs. 11 ozs.; S. 3960; L. 23; K. 120; H. 72; Lgs. 65.—48. No. 2. S. 2,200.—49. Flamingo. *(Phœnicopterus ruber, Africa).* 2,809.—50. No. 2. 2,560.

All the last named birds from No. 30, with the exception of the Flamingos, were shot in England.

AVERAGES.

¶ It will be seen that the Spleen in this order of Birds is generally very small. As specimens, I take from the first table, the Wild Duck, the Teal, and the Skua Gull. The comparative averages are, S. 2899; L. 36; K. 486; H. 103; Lgs. 117. From the second table I select three diving birds, the little Auk, the little Grebe, and the Yellow-throated Diver; and the average is, S. 3480; L. 19; P. 820; K. 93; H. 69; Lgs. 59. The large size of most of the viscera, especially of the liver and kidney, in the last named

birds is very remarkable. The weights would of course vary materially in different specimens, but the general conclusion I know is correct.

PLATES.

¶ The Spleens of the birds of this order, reduced in size as described below, are represented in Plate 2. fig. 273. Mute Swan, ½.—274 Black-necked Swan, ½.—275. Sandwich Island Goose, ½.—276. Brent Goose, ½.—277. Gannet.—278. Pelican.—279. Common Duck, ½.—280. Wild Duck, ½—281. Mandarin Duck, ½.—282. Velvet Scouter, ½.—283. Widgeon, ½.—284. Teal, ½.—285. Penguin, ½.—286.

ARTERIES AND VEINS.

¶ Before concluding this division of the animal kingdom, I am desirous of making some additional remarks respecting the circulation of the splenic and portal blood. The communicating branch of Jacobson, before named, is very large in some birds, and under certain circumstances, it is probable that a large portion of the blood of the lower extremities passes into the vena portæ. In the swans, geese, and in nearly all the *Palmipedes*, this vein is of great size; it passes from the cross branch at the posterior part of the kidneys, to the mesenteric vein, so that the kidneys and lower extremities are readily injected through this vein; or the Spleen and liver may be injected, as I have before said, through the femoral vein.

I have spoken (p. 45), of the splenic artery, as a branch of the cœliac axis, but this is not strictly correct, although it must be remembered, that in many mammals, as in the bird, a larger quantity of blood is furnished by this artery to the stomach and pancreas, than to the Spleen; and, therefore, I have called the large branch in the bird which supplies the Spleen with blood, the splenic artery. In the article, Aves, "Todd's Cyclopædia," p. 336, by Professor Owen, it is said "*that the posterior gastric almost as soon as it is formed, detaches the splenic artery*," but in the different classes of birds, I find great variations in this respect. Thus, in the sketch which I have given of the blood vessels of the Harpy Eagle, (Plate 6 E, Arteries and Veins), the cœliac artery is ¾ of an inch in length, and the splenic, or right gastric, nearly the same length, before it gives branches to the Spleen; it then supplies the liver, pancreas, gizzard, and duodenum; the left gastric furnishing the left hepatic, coronary, and intestinal branches. In many birds, a large branch to the proventriculus is given off before the division of the cœliac. In the Weka Rail I found it coming off from the aorta with the cœliac; and in other instances this trunk is furnished by the right or left gastric. In the quail, partridge, grouse, green woodpecker, duck, and in many other birds, where the Spleen is seated in the fork formed by the bifurcation of the cœliac artery, the splenic branches are given off close to this division; whilst in other birds, as in the harpy eagle, above mentioned, the distance is much greater.

In the Black necked Swan (*Cygnus nigrocollis*, *S. America*), the cœliac artery is given off an inch from the arch of the aorta. It sends a large branch, soon after its origin, to the proventriculus, and divides two inches from the aorta into the anterior, or right gastric, and the posterior, or left gastric; the splenic branches, three in number, are furnished by the right gastric trunk, which also gives off the right hepatic, and then passes on to the gizzard, pancreas, and small intestines. The left lobe of the liver is supplied by the left division, which likewise furnishes branches to the posterior part of the gizzard and to the intestines. The number of branches supplying the Spleen vary from one to six. In the Mute Swan I counted one large branch, and four smaller ones; in the Sandwich Island Goose, four; Toucan, six; Shrike, four; Blackbird, four; Peregrine Falcon, two;

but the number is not uniform even in birds of the same species. In the birds with long cylindrical Spleens, as might be expected, the branches are generally more numerous. The right gastric (or what I have called the splenic) is in close contact with the Spleen (as is well shewn in many of the Preparations), and the branches from it consequently very short.

Veins.—The splenic veins in the bird, as in the reptile, ramify chiefly on the exterior of the Spleen. This is observable in the injected preparations (107, 109, 146) of the Spleens of the Condor, Cock, and Golden Pheasant, and in Plate 3. In the Cock (the specimen alluded to) eight veins are seen under the capsule. The main trunks run from the centre to the large vein at the inferior part of the Spleen. In the Sandwich Island Goose I have traced two radicles of the vein, apparently from the surface of one of the Malpighian corpuscles, where they presented a stellate appearance; but there is much difficulty in coming to a right understanding upon this matter, as these veins in the bird, and in other animals, are sometimes injected through the arteries.

The vena portæ is formed by the gastric, œsophageal, splenic, pancreatic. intestinal, and the communicating branch of Jacobson, before alluded to, The splenic veins generally empty themselves into the gastric vein. The vena cava passes through the upper and outer part of the right lobe of the liver, where it is joined by the two hepatic veins; but it receives also numerous small branches from this part of the liver. In the Cochin China Cock I have counted as many as sixty very small openings in the cava, having crescentic valve-like edges at the posterior part.

Malpighian Corpuscles.—These are seen very distinctly in the Cock's Spleen (Prep. 109), which has been three years in Goadby's solution. Under a power of 60 diameters they present the appearance of round white bodies, the size of small peas; arterial twigs are visible upon the surface; but on making a section of the corpuscle no vessels are present in the interior. The injection employed was size and vermillion; possibly a thinner injection might have shewn them. In this instance, as in the case of the fried sheep's spleen, the albuminous contents of the corpuscle is solidified.

In some injected preparations of the Spleens of birds, the arteries are seen to terminate in tufts, presenting somewhat the appearance of a trefoil leaf; these leaf-like bodies consist of five or six bunches, which are easily detached. In the Red-throated Diver they are very plainly seen; also in the young Rook. (Plate 3). Although the exact distribution of these vessels is not clearly made out, it is tolerably certain that they are mainly distributed, as in other animals, around the Malpighian bodies, to furnish blood for their peculiar secretion.

Valves.—I have examined the portal veins of several large birds, but at present I have failed to detect valves in them.

REPTILIA.

The Spleen varies much in shape in these animals, it resembles more that of a bird than a fish; in the serpents it is irregularly oval or triangular; in the toads, frogs, and lizards round; in the alligators and crocodiles, oval, with one end more rounded than the other. (Lizards oblong, as shewn in the Plates.)—*After note.*

The Spleens of some of the smaller reptiles, like the eel, contain a large quantity of black pigment cells. The cells in the Spleen-

pulp are some of them nucleated and "faintly granular." The trabeculæ, as well as the *Malpighian* corpuscles, are less distinct in the reptiles than in the birds.

The double portal circulation, one for the liver, the other for the kidney, and the large size of the blood globules, are matters worthy of notice.

The weights of the viscera in this Table are given in grains when *ozs.* are not named, and for explanations respecting the Spleen of the Ophidians, the reader is referred to that section.

1. Tortoise. *(Testudo, Græca.)* Small; young. S. 1 gr.; L. 19; A. C. $14\frac{1}{2}$ ins..

2. Iguana. *(T. nudicollis, Jamaica.)* Obstructed bowels. B. $2\frac{1}{2}$ lbs.; S. 10 $\frac{1}{1760}$; L. 620 $\frac{1}{28}$; P. about 6 $\frac{1}{2933}$; K. 40 $\frac{1}{440}$; H. 30 $\frac{1}{586}$; Lgs. 100 $\frac{1}{176}$; A. C. 40 ins.

3. Australian Lizard. (—— ?) Very fat. B. 250 grs.; S. $\frac{1}{2}$ $\frac{1}{500}$; L. 11 $\frac{1}{22}$; H. 2 $\frac{1}{125}$; Lgs. 2 $\frac{1}{125}$; A. C. 6 ins.

4. Texan Lizard. *(Agama cornuta.)* Thin. B. 180 grs.; S. $\frac{1}{6}$ $\frac{1}{1080}$; L. 6 $\frac{1}{30}$; K. $\frac{1}{4}$ $\frac{1}{720}$; H. 1 $\frac{1}{180}$; A. C. $8\frac{1}{2}$ ins.

5. Chameleon. *(C. vulgaris, Africa.)* (Had not fed for several weeks.) B. 680; length, 6 ins.; S. $\frac{1}{4}$ $\frac{1}{2720}$; L. 15 $\frac{1}{45}$; K. 2 $\frac{1}{340}$; H. $3\frac{1}{2}$ $\frac{1}{194}$; A. C. 11 ins.

6. No. 2. Another species. B. 275 grs.; length, 4 ins.; S. $\frac{1}{6}$ $\frac{1}{1650}$; L. 13 $\frac{1}{21}$; K. $1\frac{3}{4}$ $\frac{1}{641}$; H. $\frac{1}{6}$ $\frac{1}{1650}$; L. 2 $\frac{1}{137}$; A. C. 8 ins.

7. *Boa Constrictor.* B. 30 lbs.; length 11 ft. 3 ins. *Pericarditis;* tubercles in liver and lungs; S. about 280; L. 19 ozs. $\frac{1}{25}$; A. C. 15 ft. 11 ins. This is the reptile that swallowed the blanket, as reported in the Journals, 1850.

8. *Boa.* No. 2. Diseased rectum; B. 8 lbs.; length 7 ft. 11 ins., S. about 20 grs.; L. 1,110. This Boa had not fed for ten months.

9. *Boa.* No. 3. Diseased rectum; B. 7 lbs. 7 ozs.; length 7 ft.; S. about 18; L. 1,550 $\frac{1}{33}$; K. 150 $\frac{1}{349}$; H. 220 $\frac{1}{238}$.

10. *Boa.*, No. 4. Diseased rectum; B. 7 lbs.; length 6 ft. 1 in.; S. about 25; L. 1,900 $\frac{1}{25}$; K. 197 $\frac{1}{250}$; H. 188 $\frac{1}{262}$.

11. *Boa.* No. 5. *(China.)* Diseased rectum; B. 7 lbs. 4 ozs.; length 6 ft. 6 ins.; S. about 20; L. 1,260 $\frac{1}{40}$; K. 60 $\frac{1}{850}$; H. 104 $\frac{1}{490}$.

12. *Boa.* No. 6. Diseased rectum; B. 6 lbs.; length 6 ft. 1 in.; S. about 45; L. 1,000 $\frac{1}{42}$; K. 160 $\frac{1}{264}$; H. 70 $\frac{1}{603}$.

13. *Boa.* No. 7. Young; 12 ozs.; S. about 15; L. 125 $\frac{1}{42}$; H. 15 $\frac{1}{352}$; Lgs. 45 $\frac{1}{117}$.

¶ I was not certain about the names of some of these Boas from Asia, Africa, and America, and therefore did not enter any of them; an omission of no importance as regards this inquiry. I should have mentioned that in addition to the disease of the rectum, which consisted of ulceration and cheesy deposit, the mouth was also ulcerated in some of the specimens.—*After note.*

14. Snake. *(C. Æsculapii, South of Europe).* B. 15 ozs.; length, 2 ft. 6 ins.; S. about 16; L. 164 $\frac{1}{40}$; K. 28 $\frac{1}{235}$; H. 18 $\frac{1}{366}$.

15. Rat Snake. *(Cilabothrus inornatus, Jamaica).* B. $2\frac{1}{2}$ lbs.; length, 6 ft. 4 inches; S. about 20; L. 660 $\frac{1}{26}$; K. 80 $\frac{1}{220}$; Lgs. 71 $\frac{1}{247}$; A. C. 5 ft. 8 ins.

16. Viper. *(V. berus, Europe).* B. 2 ozs.; length, 23 ins.; S. $\frac{1}{2}$ $\frac{1}{1760}$; L. 11 $\frac{1}{80}$; K. 9 $\frac{1}{97}$; H. $3\frac{1}{2}$ $\frac{1}{280}$; Lgs. 7 $\frac{1}{125}$; A. C. 22 ins.—

17. No. 2. B. about $4\frac{1}{2}$ ozs.; S. about 2 $\frac{1}{990}$; L. 25 $\frac{1}{79}$. This is the only poisonous reptile in Europe.

18. Cobra di Capello. *(Naja hagé, Africa).* Ulceration of mouth and intestines; thin; B. 1 lb. 3 ozs.; length, 3 ft. 6 ins.; S. about 20; L. 404 $\frac{1}{20}$; K. 75 $\frac{1}{111}$; H. 45 $\frac{1}{185}$; A. C. 5 ft. 6 ins.

19. No. 2. B. 1 lb. 9 ozs.; S. about 25; L. 446 $\frac{1}{24}$; K. 53 $\frac{1}{207}$; H. 60 $\frac{1}{183}$; A. C. 5 ft. 1 in.

20. Indian Cobra. *(Naja tripudians).* B. 1 lb. 10 ozs.; S. about 12 grs.; L. 500 $\frac{1}{22}$; K. 38 $\frac{1}{381}$; H. 100 $\frac{1}{114}$; A. C. 7 ft. 4 ins.

21. Rattle Snake. *(Crotalus horridus, S. America).* B. 4 lbs. 4 oz.; length, 4 ft. 6 ins.; S. about 60; L. 880 $\frac{1}{34}$; K. 140 $\frac{1}{213}$; H. 85 $\frac{1}{352}$; Lgs. 200 $\frac{1}{144}$; A. C. 5 ft. 11 ins.

22. No. 2. B. 3 lbs.; length 4 ft. 3 ins.; S. about 65; L. 1,000 $\frac{1}{21}$; K. 113 $\frac{1}{248}$; H. 85 $\frac{1}{186}$; Lgs. 320 $\frac{1}{66}$; A. C. 5 ft. 8 ins.

23. No. 3. Very fat; diseased rectum and stomach. B. 1 lb. 12 ozs.; length 3 ft. 10 ins.; S. about 30.

24. Puff-adder. *(Clotho arictans).* Two days old; bred at the Regent's Park Gardens. B. 660 grs.; S. about $\frac{1}{8}$.

25. Toad. *(Bufo vulgaris, Europe).* B. 400; S. $\frac{1}{2}$ 800; L. 15 $\frac{1}{26}$; K. 2 $\frac{1}{200}$; H. $2\frac{1}{2}$ $\frac{1}{160}$; Lgs. 3 $\frac{1}{133}$; A. C. 7 ins.

¶ The vipers and the toad were the only reptiles in the above table living in a state of nature.—*After note.*

CHELONIA.

Chelonia. The only *fresh* specimen of this order of Reptiles that I had dissected, was the Greek Tortoise, No. 1, in the table, but I had examined several specimens in spirit at the College Store-room, and I have given Sketches of the Spleen, duodenum, and gall-bladder, (Plates 15, 16, and 17, E, *Reptilia*) of the *Testudo Indica*, and of the *Testudo Elephan-*

tos, (so described on the jars), as well as of another species of Tortoise unknown. The Spleen of a Turtle is also exhibited; the veins on the *surface*, as stated under the drawing, being very numerous. These sketches, taken like all the drawings in the Essay, by measurement, shew the large size of the Spleen in the *Chelonia*. In the *Testudo Indica*, the Spleen measures about 4 inches in length, and 5 in circumference, in the middle portion; its weight about 2 ozs. In the *Testudo Elephantos* it is about 2 inches in length, and 2½ in circumference. In the third specimen about half the size of the last. In the Turtle, the length is 2 inches, and the circumference in the middle about 3 inches. The gall-bladder of the *Testudo Elephantos* is of a rounded form and of enormous size; about six times the magnitude of the Spleen.

¶ I have been fortunate in obtaining many fresh specimens of the *Chelonia*, since the first table was formed.

The weights are in grs when *lbs.* and *ozs.* are not named.

5. Indian Tortoise. (*T. Indica*). B. 40 lbs.; S. 635 1-443; L. 17½ ozs 1-26; K. 1,064 1-264; H. 440 1-640; Lgs. 1,760 1-160; A. C. 11 ft. 6 ins.

6. (*Testudo radiata, Madagascar*). B. 4 lbs. 1 oz.; S. 15 1-1906; L. 820 1-34.

7. Snap-Turtle (*Chelydra serpentina*)? B. 30 lbs.; S. 440 1-480; L. 21 ozs. 1-22; H 1,010 1-209; Lgs. 8 ozs. 1-60; A. C. 12 ft. 5 ins.

8. Hawk's-bill Turtle. (*C. imbricata, Asia*). B. 12 lbs.; S. 105 1-804; L. 3,625 1-23; P. 67 1-1260; K. 409 1-206; H. 325 1-259; Lgs. 1,860 1-45; A. C. 12 ft. 9 ins.

9. Green Turtle, (Edible Turtle). (*C. mydas, Asia*). B. 41 lbs.; very fat; S. about 220 1-1312; L. 9½ ozs. 1-69; K. 440 1-656; H. 3½ ozs. 1-187; Lgs. 14½ ozs. 1-45.

10. (*C. Caouana, Mediterranean*). B. 20 lbs.; S. 311 1-452; L. 34 ozs. 1-9. —11. No. 2. B. 18 lbs.; S. 247 1-513; L. 30 ozs. 1-9. The livers of both these Turtles were large, soft, and fatty.—12. No. 3. B. 10 lbs.; S. 121 1-581; P. 72 1-977.

13. Young Turtle. (———? *Island of Ascension*). B. 605 grs.; S. ¼ 1-2420.—No. 2. B. 434 grs.; S. 1,736.

14. Fresh-water Turtle. (*Emys longicollis, America*). B. 31 ozs.; S. 6 1-2273.

Some of the above animals had not fed for many months, a circumstance it is well to bear in mind in estimating the connexion between the Spleen and the stomach.

Situation of the Spleen.—The Spleen in the *Chelonia* is generally to the right, or in the centre of the abdomen. In the *Chelonia Caouana*, it is closely attached to the duodenum, four inches from the pylorus, having the colon on the left side. In the *Testudo radiata*, I found it nearer to the pylorus, and rather to the right side. In the works that I have consulted—I have found no accurate description of the abdominal arteries of the *Chelonia*—I extract the following note, which I made when dissecting a large Tortoise.

The circulatory apparatus is as follows. I copy from the specimen now before me, the arteries of which I have injected with wax, tallow, and vermillion. The long diameter of the cardiac ventricle (from side to side), when injected, measures three inches; the short diameter an inch-and-a-half: the long diameter of the two auricles is four inches. The pulmonary artery

partly covers the roots of the two aortæ, and divides into two branches an inch from its origin. The aortæ, as in the bird, appear at first sight to be composed of three main trunks. The anterior and left (the largest of the three) passes backwards and downwards along the left side of the spine, and twelve inches from its origin it receives the communicating branch of the right aorta; the middle trunk, two inches in length, divides into four branches, which supply the heart and upper extremities, answering to the carotids and subclavians in Mammals. The right branch is eight inches in length, and divides at its termination into several trunks, first giving off some small branches to the cardiac end of the stomach. 2nd. The coronary, a large artery, which is continued along the concave surface of the stomach. 3rd. The communicating branch to the left aorta. This is three inches in length, and when injected the size of a small goose quill. The terminal branches are two large trunks to the colon and cæcum, one to the liver, and two to the duodenum, small intestines, and rectum; the inner or duodenal branch furnishing the splenic. Several of the intestinal branches are continued upon the large oviducts and ova. The kidneys are supplied by branches from the left aorta These arteries are all of large proportionate size.

The veins on the surface of the Spleen are very large; they consist of seven or eight main trunks, which terminate (as in the bird) in the large vein at the under and inner part of the Spleen; when injected they are seen to inosculate very freely (Plate 3). The splenic vein, of large size, joins the superior mesenteric vein, which runs along the inner side of the duodenum. In the Hawk's-bill Turtle the splenic vein consists of a beautiful net-work of elastic fibres, in the form of cells; about the centre of the vein a few of these fibres are transverse, but in this specimen no distinct valves were present. I had not time to make a microscopical examination of these bands. In this reptile I found many of the veins from the stomach passing directly to the liver.

The capsule of the Spleen is loosely attached in the *Chelonia* as in the bird. The Malpighian corpuscles in some of the specimens are very distinct, varying in size from the 30th to the 40th of an inch in diameter.

Loricata.—Alligators and Crocodiles. As the anatomy of these animals differs somewhat from that of the lizards, it is better to notice them separately.

I had not had an opportunity of dissecting a fresh specimen of these animals, when the first table was completed, but the examination of the wet preparations at the College store-room, convinced me that the Spleen was of large comparative size. Three sketches are given in Plates 16 and 17 E, two of them are Spleens of young Crocodiles, (*C. Biporcatus*), and the third is the Spleen (in bottle,) of a large Crocodile (*C. acutus*,) it measures about 7 inches in length, and about 9 in circumference in the middle portion.

The following abstract (from the Lancet and Medical Times), of a communication I made to the Physiological Society, November 13, 1854, contains I think, matter of great importance as regards the function of the Spleen, I give the report as printed in those journals.

"Dr. Crisp exhibited coloured drawings of the viscera of a large alligator, taken by measurement, and then read the following communication—

"ON THE MALPIGHIAN BODIES OF THE SPLEEN OF THE ALLIGATOR AND CROCODILE, AND ON THE WEIGHT OF THE SPLEEN AS COMPARED WITH THE BODY IN THESE ANIMALS.

"Nearly all the writers on the Spleen that I am acquainted with deny the existence of Malpighian bodies in fish and reptiles—an error that a more extended examination of the vertebrate animals would readily have

corrected. These bodies are very distinct in some of the cartilaginous fishes and in many reptiles; but in none that I have examined are they so large as in the alligators and crocodiles. The preparations on the table, from the Spleen of an alligator and of a crocodile, are sufficient evidence of this, although when recently taken from the body they were more apparent. The specimen, however, in which they have been subjected to the action of dilute nitric acid displays them better. They are about the size of these bodies in the sheep and other of the Ruminants; they measured, when fresh, about the twenty-fourth of an inch in diameter. Another error of more importance respecting the Spleen is the assertion of every writer that I know of, 'That the Spleen decreases in size as we descend in the scale of vertebrate animals'—a mistake that can only have originated in that common source of error, the lazy system of taking for granted that which previous writers have stated as correct, and of not investigating for ourselves. It is from this cause that the English works on Physiology, and the articles in our Cyclopædiæ, (copied mostly from Continental writers,) are crammed with mistakes, the question too often being, 'Where does the information come from?'—not '*Is it true?*' From a recent work "On the Spleen," with which one of the reviewers was so charmed, that he broke forth into a soliloquy on Truth, I extract the following passage:—'*Reptilia.*—As we descend in the scale of the vertebrate series, the function of the Spleen appears to be considerably reduced in importance, as shown by the extreme diminution of its size—a diminution more marked than in any other of the vertebrata.' But let us test the correctness of this descending scale by the class of animals in question. I have examined ten of these—four crocodiles and six alligators, varying in weight from a few ounces to two hundredweight. All were inspected soon after death, and in seven, the bodies and viscera were carefully weighed by myself, and the alimentary canal measured. In the three largest specimens the weight of the body was only guessed at. In all, the stomach contained stones; and in one, large pine-knots, partly digested. The relative weight of the body and of the spleen in the ten specimens was as follows:—Crocodiles, 1-528, 1-502, 1-1466; a large specimen, the body not weighed, about 1-597; alligators, 1-706, 1-900, 1-1100, 1-1384; two large ones, the bodies not weighed, about 1-891 and 1-1045. If the above proportions are compared with those of some orders of birds, the alligator's spleen will be found to be relatively much heavier; and when the weight of the tegumentary covering (possessing but little vascularity) in these Saurians is considered, the proportion is greatly increased. It may be remarked, too, that some of the animals above mentioned had not fed for several months. If we investigate this descensive scale still further, and examine a lower grade of the vertebrata—viz., fishes, we find a much greater proof of its erroneousness than in the reptiles."

SAURIA.

¶ For the purpose of estimating the relative weight of the viscera to the body, I select the largest alligator and crocodile from the above ten specimens. I have not had an opportunity of dissecting a Gavial.

26. (*Crocodilus acutus, West Indies*). B. about 2 cwt.; S. 6 ozs. 1-597; L. 55 ozs. 1-66; P. about 1 oz. 1-3584; K. 7 ozs. 1-512; H. 5½ ozs. 1-651; Lgs. about 14 ozs. 1-199; A. C. 23½ ft.

27. Alligator. (*A. sclerops, S. America*). B. about 1¾ cwt.; S. 3 ozs. 1-1045; L. 33 ozs. 1-94; P. 380 grs. 1-3631; K. 5 ozs. 1-627; H. about 3 ozs. 1-1045; Lgs. 25 ozs. 1-125.

The Spleen in these reptiles that I have dissected is seated close to the duodenum, behind the stomach, and to the right of the vertebral column.

Large veins ramify on the surface, as in the *Chelonia*, and the main trunk of the splenic vein sometimes joins the large intestinal vein, to form the vena portæ; and in other specimens it enters this or one of the veins of the stomach. The capsule of the Spleen is tough; less dilatable than in Mammals, and the trabeculæ smaller and not so elastic. The Malpighian bodies however, as before stated, are of large size (Plate 3). In the largest Crocodile's Spleen, I found after exposure to the action of water, that 5-6ths of it consisted of spleen-pulp and of Malpighian corpuscles. There is no important difference between the arrangement of the abdominal arteries of these reptiles and those of the *Chelonia*; but I may mention that the œsophagus, stomach, liver, Spleen, and upper portion of the alimentary canal are supplied chiefly by the right aorta; and hence they receive a more carbonized blood.

Some of the other families of the Saurians are described below, the proportion of the Spleen and other of the viscera to the body, is given.

28. *Iguana vulgaris, S. America.* No. 2. S. 660.—No. 3. *Iguana tuberculata, West Indies* . S. 1,100; L. 49.—No. 4. S. 2,566.

29. Chameleon. No. 3. S. 1,650.—No. 4. B. 3 ozs. 93 grs.; S. 5,838. The ova in this reptile, 67 in number, weighed 640 grs.

30. Wall Lizard. (*L. Nilotica, Egypt*). S. 1,080.—No. 2. Another species (*West Indies*). 1,598,

30. Ouran. (*Psammosaurus griseus, Egypt*). S. 410; L.42; A. C. 37 ins.

31. Aldrovand's Lizard. (*Plestiodon Aldrovandi, Egypt*). B. 8 ozs. 340 grs.; S. 3 3-860; L. 190 1-20; A. C. 17 ins. The fat in the abdomen of this lizard weighed 243 grs., and the lungs and many of the muscles were studded with *echinococci.*

32. Green Lizard. (*L. viridis, France*). S. 1,388.—*Uromastix Spinepes, Australia.* S. 3,520; L. 44; A. C. 2 ft. 10 ins.—Stumped-tailed Lizard. (*Trachysaurus rugosus, Australia*). 960.—33. Texan Lizard. No. 2. (*Agama cornuta.*) 1,656.

34. *Cyclosaurus gigas, Australia.* B. $3\frac{1}{2}$ lbs.; S. 5 1-4928; L. 883 1-27; A. C. 3 ft 4 ins.

35. Viviparous Lizard. (*Zootica vivipara, Europe*). S. 960; L. 25; K. 108.

The Spleen in all the divisions of the *Saurians* is generally seated behind and to the left side of the stomach, though often to the right of the vertebral column. The artery sometimes proceeds directly from the aorta, but more frequently it is a branch of one of the gastric arteries. In two specimens of large lizards, I have seen the Malpighian corpuscles very plainly, and in one instance after injecting the Spleen of an Iguana with white lead and spirits of turpentine, the arteries were observed to end abruptly in tufts, having a mossy appearance; they were *apparently* distributed upon the Malpighian corpuscles.

I have not spoken of the Spleen-pulp in the previous families of the *Saurians*, because I have not obtained very fresh specimens, but in the little viviparous lizard of this country I have had many opportunities of examining the Spleen in a recent state. The pulp consists of blood globules in a normal state, many, shrivelled and irregular in form; numerous white round corpuscles, free nuclei, pigment granules, and often of yellow masses like bile-pigment. It is possible that the normal corpuscles were not originally in the Spleen pulp. In this reptile I have also found many of the above appearances; the altered corpuscles, more especially in the kidney and liver. The pigmentary matter in many of the lizards, as in several species of fish, is abundantly supplied to the skin, as well as to the Spleen and to other parts. In the Chameleon, Wall-lizard, Teguexin, and viviparous Lizard, it is very plentiful.

Before I speak of other specimens of the *Ophidia* that I have examined, I may allude to the difference of opinion that exists respecting the Spleen in these reptiles. I had neither read Cuvier nor Meckel when I finished this Treatise, and I now quote the following from Meckel's "Comparative Anatomy," respecting the Spleen of reptiles, (vol. viii., p. 86. 1838). "As for the Spleen and pancreatic glands of *Ophidians*, but few important and well authenticated facts have been published. Cuvier admits the presence of a Spleen in the *Ophidians*, of an elongated form, and near the intestinal canal. Meckel states "that he has not discovered this gland in all the *Ophidians*; for example, in the genera *coluber*, *boa*, *python*, *viper*, *crotalus*, *naja*, *typhlops*, *tortrix*, and *amphisbæna*," although he has searched in the situation indicated by Cuvier. He says "he has distinctly seen it in the *cæcilia* and *anguis*. In the latter it is placed on the left side of the mesentery. It presents a form slightly elongated and triangular. In the cæcilia it is much more voluminous, and of a more elongated form in the *boas*, *pythons*, *elaps*, and *couleuvres*." He adds, "that the absence of the Spleen in the true *Ophidians* agrees with the general imperfection of their structure." As regards the assertion of *M. Desmoulins*, that the size of the pancreas in *Ophidians* is enormous, Meckel denies its correctness. "The gland," he says, "is placed on the right face of the small intestine, near the pylorus. In the couleuvre, boa, and python, the pancreas surrounds the intestine like a ring. In the generality of *Ophidians* it is smooth, uniform, and non-lobated. In the boas, pythons, and roles, on the contrary, it is composed of a great number of lobes, slightly adherent one to the other, in which the excretory ducts are very apparent; and they do not unite until they arrive very near to the intestine."

Cuvier, in his "*Leçons D'Anatomie Comparée*," 1836, vol. iv., p. 636, says, "The most common form of the Spleen in the *Ophidians* is spherical or oval; it is generally very small and very difficult to distinguish from the pancreas, especially in the true serpents, in consequence of its adhesion to this viscus, and often in consequence of the similarity of colour. I have found it (the Spleen) round or pyramidal in the Ring necked Snake (*couleuvre à collier*), exceeding sometimes the volume of the pancreas, although generally much smaller than it."

In the table of the *Ophidia* (p. 113), I have not given the relative weight of the spleen to the body, because it is probable that the spleen and pancreas were sometimes weighed together; and in other instances the pancreas was taken for the spleen. I have copied, in Plate 3, fig. 298, the spleen and pancreas of a large Python from a drawing in the Essay (from preparation 124), and if Meckel's statement is correct, the mulberry-like body is the pancreas, as I have represented it, and the larger organ, the spleen; but about this, I have now much doubt.

I have examined carefully the preparations before alluded to. In the Rattle Snake, (No. 21 Table, and Prep. 118), I find the body, which I supposed to be the spleen, is closely attached to the duodenum; but I cannot discover a duct passing from it; at the upper part of this body, and intimately embedded in its structure, is a roundish tubercle-like projection in contact with the gall-bladder above. On making a section of these bodies, the larger is found to be tough, and uniform in consistence; in the latter, small cells are visible to the naked eye; these parts are so closely united, that they can scarcely be called two bodies; and to add to the difficulty, there is a round fatty mass above the gall-bladder, which I took for the pancreas. In preparation 116, the spleen (so called), is injected with size and vermillion. It is seen, under the microscope, to consist of cellular partitions, in which are cup-like depressions surrounded by the injection. The artery, about two inches in length, passes directly from the aorta. In preparation 124 of a

large Python, represented in Plate 2, the size being reduced $\frac{1}{4}$ to $\frac{1}{3}$, the round mulberry-like mass is seated about half an inch above the larger body; the former is composed of about twenty nodules, the size of small peas, and apparently possessing a distinct capsule; the outer surface of these nodules is covered with small rounded elevations, the size of pins' heads. The interior of this body is dense and compact, presenting no appearance of cells; the larger mass is like that described in the Rattle Snake above-named, and has a greater resemblance to the spleens of other reptiles than the smaller body. The parts are preserved in spirits of wine. In preparation 115, the spleen, pancreas, gall-bladder, and part of the duodenum and stomach of a Boa injected; the relative position and appearance of the two bodies is about the same as the last. In both the last preparations, an artery, about $2\frac{1}{2}$ inches in length, arises from the aorta singly; it passes through the larger body, sending off lateral branches to the interior, and it is then distributed to the lower part of the stomach and gall-bladder. The smaller body is supplied by an arterial branch from above (probably from one of the gastric). A section of this body shows white cellular bands, with the interspaces injected, as exhibited in Plate 3. It has a greater resemblance to the spleen than any of the before-mentioned.

It must be recollected that none of these reptiles were in a healthy state. The spleen (so called), liver, and lungs, were studded (Prep. 124, above described), with small miliary tubercles. The specimens, too, were generally not examined until some time after death; and the red colour, so characteristic of the spleen of most animals, was not present in these.

The vipers I dissected were the only *Ophidians* living in a state of nature; but these were not recent specimens, and want of time prevented an examination of the common Snake (*Coluber natrix*)—a reptile I thought I could procure at any time.

It will not be irrelevant to the present inquiry to allude to some parts of the anatomy of this reptile, as it will give a tolerably correct notion of these parts in the other *Ophidians*. The snake now before me, the arteries of which I have injected with white paint, is 32 inches in length, and weighs 3 ozs. 10 grs. The heart is seated four inches from the mouth; the liver, one-lobed, commences close to the heart, it is five inches in length; the gall-bladder is placed three inches below the point of the liver; and the spleen and pancreas are immediately below this on the right of the duodenum; the right kidney is two inches above the left; the anus, six inches from the tip of the tail; the alimentary canal measures 33 inches. The aorta gives off numerous small branches to the posterior part of the liver, the œsophagus, and to the intercostal muscles. The first large branch to the stomach arises near the *cardia*; the next, near to the pylorus; the third, and largest trunk, $\frac{3}{4}$ of an inch in length (the *cœliac*), arises opposite to the spleen. It passes downwards and inwards, terminating in two branches; one passing upwards to supply the pancreas, spleen, gall-bladder, and pylorus; the other descending along the alimentary canal; a fifth branch, $2\frac{1}{2}$ inches from the above, supplies the lower intestines and ovaries; two small branches (nutritive) are sent to each kidney; several branches to the rectum. The vessel gradually decreases in size as it passes on to the extremity of the tail. Besides the above, numerous twigs pass off at irregular intervals to the intercostal spaces. In contact with the gall-bladder below, (represented in Plate 2, fig. 300), is a rounded body, the size of a small pea, imbedded in a gland about four times its size. The artery before spoken of divides into two branches, which pass along the sides of the larger gland, sending branches to the interior, and forming a net-work of vessels on its surface. The terminating arteries dip into the smaller gland, but no superficial trunks are visible. Both these bodies are closely united to the gall-bladder by means of cellular tissue.

An injection of the portal vein with yellow paint shews the veins on the surface of both these bodies, the smaller branches inosculating with each other. In another specimen, injected with paint, the veins on the surface of the smaller body were more distinctly seen, and the nodules were enlarged by the injection. The blood from the glands described, passes chiefly by a large trunk at the lower part of the larger gland, into the long vena portæ, or mesenteric vein, which carries a part of the blood from the kidneys and intestines, and through which the kidneys are well injected. The vena cava, as in all the *Ophidians* I have dissected, passes through the anterior and central part of the liver to the heart, receiving numerous lateral branches of the hepatic veins which enter it at right angles. The vena portæ is readily injected through the vena cava. The circumstance of the most importance, as regards our inquiry, is the mixture of the renal and hepatic blood.

Some of my readers may think the above description unnecessarily prolix, but I introduce it, believing that a minute account of the abdominal circulation is especially necessary in investigating the use of the spleen; and I, moreover, know of no author who has minutely described it in the *Ophidians*.

I now pass on to the microscopical examination of these bodies, which I have made immediately after death. The pulpy part of the smaller body contains normal and shrivelled blood-corpuscles, pigmentary granules, free and in cells, numerous white round corpuscles, about the $\frac{1}{1000}$ of an inch in diameter, and small round nucleated vesicles. The larger body also contains many shrivelled corpuscles, pigmentary matter, smaller white corpuscles, some apparently nucleated, and innumerable small round vesicles, highly refractive, about the $\frac{1}{10000}$ of an inch in diameter, and in this last respect, has a greater resemblance to the pancreas of some other reptiles (toads and fogs, *e.g.*) On the addition of water, and when flowing, most of these shrivelled and narrow corpuscles assume their natural shape; *a fact apparently overlooked by the advocates of the decomposition theory*, who have not, I think, sufficiently taken into account the *mechanical* effect on crowded blood-corpuscles in the spleen, and other organs. In the kidney, the altered corpuscles, pigmentary matter, white corpuscles, and free vesicles, are very abundant. In the liver, the blood-corpuscles, many of them are reduced one-fourth in their short diameter, but the addition of water expands them, and they are seen to unfold (many of them) as they flow. In this organ, the free vesicles before spoken of, which, exclusive of their greater uniformity of size, have some resemblance to fat globules, are very abundant; the white round corpuscles are fewer in the liver, and the nucleated vesicles more abundant; a yellowish and black pigmentary matter is also present. Some of the above are represented in Plate 3.

After immersion in water for a few days, I find the yellow elastic curly fibre in both; but in the larger body the white fibrous tissue greatly preponderates. Taking all circumstances into account, I think there can be but little doubt that the smaller body is the Spleen, and the larger, the pancreas; although at present I have been unable to find its duct.

Before I proceed to the description of the foreign members of this family, more recently dissected, I will speak of the weight of the viscera of the three *Ophidians* of this country, the Slowworm (*Anguis fragilis*), the Ring-necked Snake (*Natrix torquata*), and the Viper (*V. berus*).

I assume that the smaller body is the Spleen, and the larger, the pancreas; the proportions of the one to the other of these bodies vary in different specimens from 1 to 10. The weights of the body and of the viscera are all in grains.

Snake.—(Seven specimens examined).—1. Body, 2,100 grs.; S. 1; P. 5.—2. B. 3,960, including eggs, which weighed 2,200; S. 2; P. 6.—3. B. 1,320; S. $\frac{1}{2}$; P. 6.—4. B. 1,630; S. $\frac{1}{2}$.—5. B. 1,664; S. $\frac{1}{2}$; P. 3.

In the two following I give the weight and proportions of the viscera.—6. B. 2,005; S. $\frac{1}{2}$ 1-4019; L. 84 1-23; P. 5 1-401; K. 15 1-133; H. 8 1-250; Lgs. 12 1-167.—7. B. 1,636; S. $\frac{1}{2}$ 1-3272; L. 9 1 18; K. 11 1-148; H. 9 1-181.

Viper.—The differences in the anatomy of the Viper are not of sufficient importance to require mention here; the larger and inferior placed body is of a more triangular shape than in the Snake, and of smaller size. The relative position is exactly the same. The heart is seated five inches from the nose; the Spleen and pancreas twelve; the anus is only two inches from the tip of the tail. The length of the eight specimens I have examined varies from 18 to 23 inches; that of the alimentary canal, from 20 to 24 inches. The weights below are all in grains.—No. 1. B. 1,320; S. $\frac{1}{2}$.—2. B. 880; S. $\frac{1}{3}$.—3. B. 880; S. $\frac{1}{2}$.—4. B. 75; S. $\frac{1}{2}$.—5. B. 1,942; S. $\frac{3}{4}$.—6. Male; B. 816; S. $\frac{1}{2}$.—7. Female (found with the last). B. 1,320; S. $\frac{1}{2}$.

8. I give the proportions of the viscera to the body in the last specimen. B 1,070; S. $\frac{1}{2}$ 1-2140; L. 30 1-35; P. $\frac{1}{2}$ 1-2140; K. 18 1-59; H. 6 1-178. The word *about* must be added to the fractions, as the weights of the Spleens were all guessed at.

Slowworm.—This reptile, which feeds chiefly on the smaller *gasteropoda,* it will be remembered, approaches nearer to the lizard in structure, having rudimentary bones of the extremities. There is also, as in most of the lizards that I have examined, a layer of pigmentary matter under the abdominal walls.

The Spleen, too, partakes more of the *Saurian* character, both in form, situation, and colour; an interesting fact, as shewing the general correspondence of the Spleen to the structure of the animal. This organ, seated to the right of the duodenum, the pancreas to the left, unlike that of the true *Ophidians*, is of a claret colour, and of an oblong shape, (See Plate 2, fig. 299,) with veins ramifying on its surface. I have examined three specimens No 1. B. 367 grs.; length 13 ins.; S. $\frac{1}{2}$ 1-734; seated four inches from the nose. 2. Young. B. 79 grs.; S. $\frac{1}{10}$ 1-790. 3. B. 440; length 11$\frac{1}{2}$ ins.; S. about $\frac{5}{6}$ 1-528; L. 12 1-36; K. 6 1-73; H. 2 1-220; A. C. 13$\frac{1}{2}$ ins. Anus 4 ins. from the tip of the tail. The above eighteen reptiles were generally killed soon after they were captured.

I now pass on to notice other specimens of the *Ophidians* living in confinement, and many of them diseased. In the first table the pancreas and Spleen have often been weighed together as one organ, their intimate junction, and similarity of colour, having led to this error, as the preparations demonstrate. The *proportionate* weight of the Spleen and pancreas to the body is only given in the subjoined, except in the rarer species.

No. 70. Glass Snake. *(——? Dalmatia).* B. 8 ozs.; Lt. 34 ins.; S. 1 1-3520.—71. No. 2. Lt. 3 ft.; proportion of Spleen to body about the same as the last. The anus 23 inches from the tail. The Spleen of this reptile, which bears some resemblance to the eel, is not united to the pancreas.

71. *Amphisbæna fuliginosa.* B. 18$\frac{1}{2}$ oz.; Lt. 43 ins.; S. 2 1-4070: L. 453 1-17; P. 9$\frac{1}{2}$ 1-856; K. 57 1-142; H. 25 1-406; A. C. 40 ins.

72. Sand Snake. *(——? Africa).* B. 3 ozs.; Lt. 19 ins.; S. and P. 4 grs.; A. C. 22 ins.

73. Yellow Snake. *(C. inornatus, Jamaica).* No. 2. B. 16$\frac{1}{4}$ ozs.; S. 6 1-1191; P. 10 1-715.

74. Chicken Snake. *(C. guttatus, West Indies).* B. 2 lbs. 11 ozs.; S. 3 1-6306; P. 16 1-1182.

75. Python. *(Regius, West Africa).* B. 8 $\frac{1}{4}$ lbs.; Lt. 9 ft.; S. 10 1-5808; P. 56 1-1037.

76. Python. *(P. Sebæ, Africa).* B. 3$\frac{1}{4}$ lbs.; Lt. 4 ft. 1 in.; S. 4 1-5720; P 20 1-1144. 77. No. 2. B. 2 lbs. 5 ozs.; Lt. 4 ft. 2 ins.; S. 4 1-4020; P. 12 1-1356; A. C. 4 ft. 4 ins.

78. Boa. (——? *St. Domingo).* B. 21 ozs.; S. 2 1-4620; P. $9\frac{1}{2}$ 1-972; 79. Purple Boa. (——? *St. Domingo).* B. 1 lb. 15 ozs.; S. 2 1-6820; P. 12 1-1136.—80. Rock Snake. *(Python Molurus, Asia).* B. 14 lbs.; Lt. 9 ft. 2 ins.; S. and P. 61 1-1615.

81. Egyptian Cobra. No. 3. B. 1 lb. $10\frac{1}{2}$ ozs.; Lt. 5 ft. 1 in.; S. 5 1-2332; P. 13 1-896; A. C. 6 ft. The Spleen seated three feet from the nose, and six inches below the lower end of the liver. It was intimately united to the pancreas, but in both these specimens the pancreas had a lobated appearance; the Spleen was smooth. This reptile deposited 9 eggs a short time before its death.—81. No. 4. Male. Bitten a few weeks before death by one of its own species. B. 2 lbs. 7 ozs.; Lt. 5 ft. 11 ins.; S 11 1-1514; P. 30 1-570; A. C. 7 ft. 8 ins.

82. Puff Adder. No. 2. B. 4 lbs. 3 ozs.; length 3 feet; S. 3 1-9828; L. 1,440 1-20; P. 33 1-893; H. 127 1·232; H. 91 1-323; A. C. 4 ft. 3 ins.—83. No. 3. B. $2\frac{1}{2}$ lbs.; length 2 feet 11 ins. The viscera in weight nearly the same as the last. The stomach, part of the liver, and gall-bladder, spleen, pancreas, and upper part of the alimentary canal, are supplied chiefly by a single branch from the aorta near the cardia. It remains as a single trunk for the space of three inches, when it divides into the three principal branches which are furnished to the above parts. In this reptile, there were 27 large ova; 12 on the right side and 15 on the left. 84. *Cerastes* ——— ? (New species, *Africa.*) B. 8 ozs.; length 2 ft. 2 in.; A. C. 2 ft. 11 ins.; Anus $1\frac{1}{2}$ in. from the tip of the tail; L. 198 1-17; K. 35 1-100; H. 21 1-168. I could discover neither Spleen nor pancreas in this reptile, but it had been dead three days, and was very thin.

I have dissected many species of *Ophidians* which I have, preserved in spirits, especially among the family of the *Coluberidæ.* In all these, the small body described as the Spleen, is on the right side, in contact with the gall-bladder, having the pancreas behind, and to which it is generally closely united. In these specimens of reptiles, which were living in a state of nature, the Spleen appears to be relatively larger and of a darker colour. In a specimen of that curious reptile the Whip Snake, (*Dendrophis athætulla),* which measures 4 ft. 2 inches in length, and weighs only 600 grains, I find the Spleen is placed 21 inches from the nose, the anus 15 inches from the end of the tail, forming a curions contrast with some of the *Crotalidæ,* where the vent is very near to the tail. The Spleen and pancreas in the last-named, are in the usual situation. The Spleen weighing about a $\frac{1}{4}$ of a grain, the pancreas about one grain. I have not had an opportunity of examining any of the *Hydrophidæ,* (Water Serpents), nor of the *Cæcilia,* (Naked Serpents).

BATRACHIA.

Batrachia.—In the original Essay, Plate 17, *(Reptilia),* I have represented from reptiles in spirits in the College Collection, seven specimens of the Spleens of Frogs and Toads, all of a rounded form. The Spleen of the Bull-frog, *(Rana pipiens),* (the reptile weighed 17 ozs.) is about the size of a small nut; the Spleens of the Tree-fog, *(Hyla arborea),* Edible Frog, *(Rana esculenta),* and of a large Chinese Frog, vary according to the size of the reptile, and the same remark applies to the Toads. In the same plate I have given a magnified representation of the Spleen, aorta, and vena portæ of a Bull-frog, the arteries injected. A large short branch

from the aorta, corresponding with the cœliac divides into two branches, and these subdivide; the upper into three trunks to the stomach and liver, the lower into two divisions, the first supplying the Spleen, pancreas, and part of the stomach, whilst the inferior goes to the intestines.

¶ In Plate 2, fig. 301, I have given a sketch of the intestinal canal, Spleen and pancreas of the common frog; the Spleen is seated to the right of the stomach, but on the left of the mesenteric fold, near to the gall-bladder, having the small intestine on the right side, and the large rectum below. The splenic vein, as seen in the drawing, enters the mesenteric formed by branches from the rectum. A part of the blood from the kidneys and the lower extremities, as in other reptiles, flows into the liver. The pancreas is generally tri-lobed, one slip passing to the liver, another along the stomach, and the third towards the Spleen. The above description will nearly apply to the toad. In the other *Batrachian* of this country, the Triton, (*T. cristatus*), the Spleen of an oblong form, is seated on the left side of the stomach, and often in the right of the spinal column; its relative position with regard to the pancreas is similar to that of the Sand Lizard, (*L. zootica*), the distribution of the vessels presents no important deviation, After decapitation, I have seen the blood flowing through the splenic vein from the Spleen, and in a short time, in consequence probably of some stoppage of the current in the liver, retrograde into the Spleen.

Microscopic appearances.—On a careful injection of the Toad and of the Frog, the veins are seen to ramify on the surface of the Spleen, and to inosculate with each other as in the other reptiles. I have not seen Malpighian corpuscles in the Spleens of the *Batrachians*. The Spleen-pulp presents many phenomena of great interest. The red corpuscles are many of them shrivelled and narrowed, but the addition of water, as before mentioned, restores most of them to their normal condition. White, round mulberry-shaped corpuscles are very numerous; they are about the 1-1000 of an inch in diameter, and have much resemblance to pus-corpuscles; the addition of water renders them more distinct. Besides these, pigmentary matters, granules, vesicles, and sometimes small blood globules are present. The liver often contains more of the altered blood-corpuscles than the Spleen, but the white corpuscles are less numerous. In the kidney both the last described are often very abundant, as well as the pigmentary matter. In the Triton I have observed nearly the same appearances.

As the rapidity of digestion is a question of some importance as regards the function of the Spleen, I may remark that some members of this class at certain seasons are very ravenous; toads and frogs consume large quantities of insects and worms, and they are quickly digested, as I have ascertained. I give the bill of fare of a large Python (*P. reticulata*) now at the Regent's Park Gardens. July 6, 1855, four large ducks; 13th, two ducks; 20th, three ducks; 29th, four ducks. When it is considered that the bones, feathers, and all are got rid of, the digestion must be tolerably good. These reptiles, however, as is well known, will go a long time without food. A Boa which I dissected had not fed for ten months.

¶ The circulation of reptiles is another matter that is not irrelevant to the present enquiry. The statement that an *Ophidian* has only one ventricle is scarcely correct, as I have shewn at the Physiological Society. The septum of the ventricle is imperfect, but in many there are two distinct ventricles. (*Python molurus, e. g.*)

In the crocodiles and alligators the ventricles are perfectly distinct, and the brain does not receive black blood. The activity, too, of some reptiles at certain seasons is very great. The little Sand Lizard of this country will run nearly as fast as a mouse.

There is a curious circumstance relating to the poison of reptiles, which, although not connected with my present subject, I may briefly allude to here. I have inserted the poison of the viper into wounds in toads, frogs, lizards, and many insects, without producing any apparent effect; the matter requires further investigation, but I think it will be found hereafter that these animals are insusceptible of the action of this poison. A toad will swallow wasps and bees in great abundance, and I found that the sting of a hornet in the palate produced no apparent effect upon one that I kept in confinement.

It will be seen that the *Chelonia* and *Loricata* have large Spleens, and if the weight of the dermal covering is taken into account, the Spleen in these animals is relatively heavier than in most mammals. The slow-moving tortoise has a larger Spleen than the swift hare, and the falcon a bird that cleaves the air at the rate of eighty miles an hour, has this organ considerably smaller than the creeping toad.—*After note.*

AVERAGES.

¶ For the *Chelonia*, *Loricata*, and *Sauria*, I refer the reader to the Tables. I have examined a great many specimens of the Frog and Toad, and the following are the proportions to the body. Tree Frog, 400; Common Frog, 1,230, 802, 930, 1,010; Toad, 870, 1,780, 1,236, 1,710. These were all full grown; but in some of the younger *Batrachians* the proportionate size of the Spleen is greater. For the averages of the viscera let us take the reptiles of this Island; all selected were living in a state of nature. *Ophidians*—Slowworm, Snake, and Viper, general average; S. 2,229; L. 31; P. 375; K. 88; H. 216.—*Saurians*—Sand Lizard; S. 960; L. 25; K. 108; H. 108.—*Batrachians*—General average of the viscera of the Triton, Frog, and Toad; S. 1,036; L. 30; P. 570; K. 244; H. 197; Lgs. 143. The weights will, of course, vary in different specimens.

PLATES.

¶ The Spleens of reptiles are represented in Plate 2, and reduced in size as described below, (Fig. 296.) Tortoise (large), $\frac{1}{8}$.—297. Crocodile (large), $\frac{1}{20}$.—298. Spleen and pancreas of Boa Constrictor, from Plate 16 E, reduced, $\frac{1}{4}$.—299. Spleen and stomach of Slowworm, $\frac{1}{2}$.—300. Spleen, pancreas, and part of the stomach of the Common Snake, $\frac{1}{2}$.—301. Alimentary canal of the natural size, with Spleen, pancreas, and mesenteric veins of the Frog. *(R. temporaria)*. 1. Spleen; 2. Pancreas; 3. Splenic Vein; 4. Rectum; 5. Stomach.—302 Spleen of Iguana, $\frac{1}{2}$.—302. Chameleon, (*n. s.*)—303. *Triton cristatus*, (*n. s.*)—304. Texan Lizard. *(Agama cornuta)*. (*n. s.*)—

304. Sand Lizard, (*n. s.*)—306. Wall Lizard, (*n. s.*)—307. *Cyclosaurus gigas*, $\frac{1}{2}$. —308. Spleen and pancreas of Puff-Adder, $\frac{1}{2}$.—309. Spleen and pancreas of Egyptian Cobra, $\frac{1}{2}$.—310. Bull Frog.—311. Edible Frog.—312. Tree Frog.—313. Common Frog.—314. Toad. (*B. vulgaris*).—All the Spleens of tho *Batrachia* are represented of the natural size.

I had not had an opportunity of dissecting any fresh specimens of those curious animals, the only *true* amphibians, which form a connecting link between the reptiles and the fishes, the *Menopoma*, *Amphiuma*, *Axolotl*, *Menobranchus*, *Proteus*, and *Syren*. At the college store-room, I examined the two Syrens, American and African, and I have given rough sketches of their bodies, and of the viscera (Plate 15). *Reptilia.*—In the latter, (*Lepidosiren*), a flattened body, $2\frac{1}{2}$ inches in length is seated on the right of the stomach; this I have represented as the Spleen. In the larger Syren, from America, the Spleen is represented as a round body, about the size of a pea, near to the stomach; the pancreas, a narrow slip, four inches in length. I made the sketches without taking notes, and, therefore, cannot speak positively about these organs. Since then, my friend, Dr. W. F. Daniell, brought me a specimen of the *Lepidosiren* from the Gambia, and I am, therefore, now able to speak with more certainty upon the matter. The following are the notes of my examination, which I have recently made, and although the animal had been some time in spirits of wine, the large blood-globules in the heart were distinctly visible. They measured in their long diameter $\frac{1}{750}$ of an inch; in their short diameter $\frac{1}{1125}$; the long diameter of the nucleus $\frac{1}{1500}$. Several of the nuclei appear to have lost their cell-walls. Large white mulberry-like corpuscles are also present, with some yellow pigmentary matter. The animal weighed 1,400 grains, and measured nine inches in length; the anus, six inches from the nose; the alimentary canal, straight, and also six inches in length. The heart surrounded by a dense white *pericardium*, and seated near to the palate, as in the fish. The liver one-lobed, white, with a large gall-bladder imbedded in its centre. Between the liver and stomach on the right side, in contact with the gall-bladder, is a spongy body of a mottled dark appearance from pigmentary matter. It is closely attached to the stomach, and its lower end curls under this organ, and is closely united to the large intestine. A long flattened yellow body, probably the testicle, passes on each side from the anus to the upper part of the liver. The kidneys, like the Spleen, are spongy and full of black pigment. On a microscopic examination, the pigmentary matter is seen to be deposited on the kidney and Spleen in cylindrical masses of an irregular form, having the appearance of blood-vessels injected with ink. Upon the skin this pigment is of a more stellate form; the surface of the liver is studded with irregular shaped spots of a lighter colour. I *think* the body I have mentioned is the Spleen, but it is only by the careful examination of recent specimens that this matter can be satisfactorily determined. I was unable to make a proper injection of the viscera in consequence of the injury done to them, but I find that a large vein passes along the back part of the liver to the heart as in the eel, to which fish the *Lepidosiren* bears some resemblance. The pigmentary matter I have described in the spleen, kidney, liver, and skin, is very abundant in the same organs in the eel.

PISCES.

In the investigation respecting the comparative weight of organs, there is an advantage in this class of animals which we find in no other, viz. :—that they are all nearly in a healthy condition—death being produced by removal from their natural element; but in most of the other classes, the animals that are kept in confinement, including the domesticated, are not in a normal state; and in those killed by violence,—bleeding, for example, the mode of death may have something to do with the condition of the Spleen; this (as before remarked), is especially evident in horses that are killed by blows upon the head, or by bleeding; and it, I think, affords an additional clue to one of the offices of the Spleen. In remarking to a man that a horse's Spleen was very full of blood, he replied, "Yes, Sir, he was knocked on the head, and not stuck."

Situation.—As in the bird, the Spleen of most fishes is on the right side of the stomach, or œsophagus, covered by the right lobe of the liver, and near to, or in contact with, the gall-bladder.

Weight.—The weight of this organ in many fishes is greater than in any other animal, in proportion to the weight of the body; and the Grey Mullet and the Gurnard, especially, have very large Spleens. The table of averages (page 28), shows the proportions.

Colour.—The colour of the Spleen is generally of a dark purple or lake, and forms a curious contrast with that of the liver, which is mostly of a whiteish hue.

Consistence.—The consistence is less firm than in any other class of animals, and the trabeculæ less distinct. There is another peculiarity too, about the Spleen of the fish which is worthy of mention; when immersed in water it soon becomes soft; the pulpy matter is easily squeezed out, and the capsule, trabeculæ, and arteries are left; this is beautifully seen in the Preps. of the Cod and the Angler *(Lophius Piscatorius).* The subjoined drawing, too, of the latter, is an exact representation of the arteries and tufts, after being in water for a few days.

Malpighian Corpuscles.—These in the bony fish are very indistinct; in the cartilaginous I have seen them in the Skate only.

Spleen Pulp.—This is generally composed of transparent

irregular shaped cells, some of them nucleated; and in the Spleens of many fish, some oil globules are present.

The shortness of the alimentary canal (often shorter than the body), the blood of the portal system, as in birds and reptiles, being received partly from the tail and lower extremities; the temperature of the body, and the size of the blood corpuscles, especially in the Siren, are important features to bear in mind.

In the following table the weight of the viscera is in grains.

No. 1. Perch. *(P. fluviatilis)*. B. 8 ozs.; S. 2 $\frac{1}{1760}$; L. 40 $\frac{1}{88}$; H. 5 $\frac{1}{704}$; A. C. 7 ins.

2. Gurnard. *(T. cuculus)*. B. 10 ozs.; S. 28 $\frac{1}{157}$; L. 220 $\frac{1}{20}$; A. C. 27 ins.

3. Mackarel. *(S. scomber)*. B. 11 ozs.; S. 5 $\frac{1}{968}$; L. 55 $\frac{1}{88}$; H. 10½ $\frac{1}{460}$; A. C. 16 ins.

4. Grey Mullet. *(M. cephalus)*. B. 10 ozs.; S. about 30 $\frac{1}{146}$.

5. Angler Fish. *(Lophius Piscatorius)*. B. not weighed, about 10 lbs.; S. 150 $\frac{1}{469}$.

6. Wrasse. *(Labrus maculatus)*. B. 50 ozs.; S. 18 $\frac{1}{1222}$; L. 870 $\frac{1}{24}$; H. 18 $\frac{1}{1222}$; A. C. 15 ins.

7. Carp. *(C. carpio)*. B. 33 ozs.; S. 20 $\frac{1}{726}$; L. 210 $\frac{1}{869}$; K. 22 $\frac{1}{660}$; H. 20 $\frac{1}{726}$; A. C. 14 ins.

8. Prussian Carp. *(C. gibelio)*. B. 8 ozs.; S. 12 $\frac{1}{293}$; L. 120 $\frac{1}{29}$; K. 15 $\frac{1}{234}$; H. 10 $\frac{1}{352}$; A. C. 16 ins.

9. Gold Fish *(C. auratus)*. B. 83; S. $\frac{1}{5}$ $\frac{1}{415}$; L. 1½ $\frac{1}{55}$; A. C. 4½.

10. Tench. *(T. vulgaris)*. B. 14 ozs.; S. 6 $\frac{1}{1010}$; L. 90 $\frac{1}{68}$; H. 12 $\frac{1}{513}$; A. C. 12 ins.

11. Salmon. *(S. Salar)*. B. 126 ozs.; Lt. 24 ins.; S. 100 $\frac{1}{554}$; L. 888 $\frac{1}{58}$; H. 90 $\frac{1}{561}$; A. C. 30 ins.

12. Herring. *(C. Harengus)* B. 6½; S. 2 $\frac{1}{1430}$; L. 14 $\frac{1}{204}$; H. 3 $\frac{1}{953}$; A. C. 8½ ins.

13. Sprat. *(C. Sprattus)*. B. 286; S. ¼ $\frac{1}{1154}$; A. C. 4 ins.

14. Smelt. *(Osmerus eperlanus)*. B. 920; S. 1 $\frac{1}{920}$; L. 12 $\frac{1}{76}$; H. 3 $\frac{1}{306}$; A. C. 5 ins.

15. Cod. *(M. vulgaris)*. B. 444 ozs.; Lt. 39 ins.; S. 240 $\frac{1}{814}$; L. 21 ozs. $\frac{1}{21}$; A. C. 54 ins.

16. Haddock. *(M. Æglefinus.)* B. 45 ozs.; S. 15 $\frac{1}{1320}$; L. 620 $\frac{1}{31}$; H. 160 $\frac{1}{123}$; A. C. 27 ins.

17. Whiting. *(Merlangus vulgaris)*. B. 10 ozs.; Lt. 10 ins.; S. 3 $\frac{1}{1466}$; L. 206 $\frac{1}{21}$; A. C. 13½ ins.

18. Holibut. *(P. hippoglossus)*. B. 592 ozs.; S. 220 $\frac{1}{1184}$.

19. Flounder. *(P. flesus)*. B. 7 ozs.; S. $4\frac{1}{2}$ $\frac{1}{684}$; L. 35 $\frac{1}{88}$; H. $2\frac{1}{2}$ $\frac{1}{1232}$; A. C. 10 ins.

20. Eel. *(A. vulgaris)*. B. 16 ozs.; S. $4\frac{1}{2}$ $\frac{1}{1564}$; L. 85 $\frac{1}{82}$; K. 15 $\frac{1}{469}$; H. 5 $\frac{1}{1408}$; A. C. $9\frac{1}{2}$.

Coloured drawings of the Spleens of the above, are given including the stomach, liver, and intestinal canal. I have also figured by measurement in Plates 9 and 10 E, the Spleens of some rare fishes in the College store-room, which are represented on a reduced scale in Plate 2, as described hereafter. No. 1. Spleen of Electric Eel. *(Gymnotus electricus)*. B. $2\frac{1}{2}$ lbs.; length 2 ft. 7 ins. The Spleen of a rounded, flattened form, the longest diameter an inch, and weighing about 60 or 70 grains. The viscera, also figured, are included within an oval space, measuring only $3\frac{1}{4}$ inches in length.—2. Pipe-fish. *(Syngnathus)*. The Spleen of a flattened, irregularly triangular form.—3. Ballister of nearly the same shape.—4. Large Basking Shark. *(Squalus maximus)*. Spleen in bottle, very large, and composed of numerous lobules the size of walnuts.—5. Hammer-Headed Shark. *(Zygæna)*. Two specimens, one 5 inches in length and lobated, the other from a young specimen weighing 4 ozs.; the Spleen about 1 grain, and *not lobated*, and this appears to be the case in two young specimens of the common Shark, *(Carcharias vulgaris)*, judging from my sketches.—6. Two Spleens of the Dog-fish. *(Scyllium canicula* and *S. catalus)*. The Spleens large and forked, in the former a narrow strip 3 inches in length runs towards the liver.—7. The hearts, livers, and alimentary canals of the Lamprey, *(Petromyson marinus)*, and of the Lampern, *(P. fluviatilis)*, in *neither of which could I find a Spleen.*

¶ As the size and weight of the Spleen of the Fish appears to have been much underrated by all previous enquirers, I have paid great attention to this subject; and have weighed many specimens of the same species, in several of the families of this class, as the examination of one specimen may lead, as in the other classes of *vertebrata*, to very erroneous inferences. In the first table, the Spleens of some—the Mullet, Gurnard, and Prussian Carp especially—appear to have been very large; but probably, if a greater number of the same species had been examined, the Spleen would have been found proportionately smaller, whilst in the Eel, and other fishes, it would have been larger than that stated in the table. The evidence, however, is quite sufficient, as far as my dissections have gone, to shew that fishes not only have larger Spleens generally than birds and reptiles, but that the organ in this class is relatively larger than in many of the Mammalians.

In the subjoined table, after giving the *proportionate* weight of the Spleen, and sometimes of the other viscera to the body, I shall occasionally allude to the microscopic appearances, and to other matters that bear upon the subject.

No. 28. *Acanthopterygii, Percidæ.* Twelve specimens of the common Perch examined. The following are the proportions to the body; the weight of the fish varying from two to twelve ozs.—880, 844, 562, 776, 720, 805, 1,026,

616, 660, 640, 754, 546. Average *about* 1-712. The Spleen is seated on the right side of the duodenum, a loop of the intestine folding over it.

29. Stickleback. *(Gasterosteus aculeatus)*. (Two specimens). 135, 168.

30. *Scomberidæ*. Mackarel (Five specimens). 712, 968, 977, 888, 880.

31. Red Mullet. *(M. Barbatus)*. 590.—32. Balloon Wrasse. *(Labrus maculatus)*. B. 15¾ ozs.; S. 1,386.

33. Wolf-fish. *(Anarrhicas lupus)*. B. 12½ lbs.; Lt. 2 ft. 9 ins.; S. 110 1-800; L. 1,880 1-46; K. 506 1-173; H. 120 1-733; A. C. 46 ins. For other points relating to the anatomy of this fish, see "*Annals of Natural History*, 1851."

Malacopterygii Abdominales. 34. Carp. *(E. rex carporum.)* B. 6 lbs.; S. 69 1-612.—No. 3. 10 lbs. tumor in the abdomen, weighing 4 lbs. 1 oz.; ova 17 ozs.; S. 147 1-479. (See *Transactions of the Pathological Society*, 1854, p. 347).—No. 4. 1-440. Shrivelled and narrow blood-corpuscles in the liver, Spleen, and kidney, with pigmentary matter. The corpuscles, on the addition of water, lose their narrow form. The splenic artery in the carp, as in the cod-fish, runs along the Spleen, and gives off lateral branches.

35. Barbel. *(B. communis)*. B. 2 lbs. 2 ozs.; length 16 ins.; S. 364; L. 53; K. 515; H. 831; A. C. 30 ins. Numerous crystals in the spleen-pulp.

36. Bream. *(Abramis vulgaris)*. B. 3 lbs. 5 ozs.; S. 645; L. 63; K. 416; H. 1,110; A. C. 22 ins—No. 2. 28. S. 2,240. The Spleen in the centre of the abdomen, close to the rectum. The blood of the splenic vein, and of the aorta, present the same appearance. In the spleen-pulp are numerous white corpuscles, like the nuclei of the blood discs; the same in the kidney.

37. Gudgeon. *(G. fluviatilis)*. (Seven specimens). 1,015, 624, 650, 1,000, 500, 450, 680. Pigmentary matter in Spleen, kidney, liver, and skin. In some parts its assumes a beautiful stellate arrangement.

38. Tench. *(C. tinca)*. (Three specimens). 536, 852, 850. Spleen on the left of the stomach.—Pope —— ? (Three specimens). 1,000, 540, 726. The spleen behind the stomach to the right of the mesial line.—39. Roach. *(L. rutilus)*. (Three specimens). 536, 670, 360. The Spleen to the left of stomach.—40. Dace. *(L. vulgaris)*. 908, 1,185.—41. Minnow. *(L. phoxinus)*. 430, 745.—42. Chub. *(L. cephalus)*. B. 15 ozs.; S. 253; L. 90; K. 660; H. 660; A. C. 17 ins.

43. Pike. *(Esox lucius)*. (Four specimens). No. 1. B. 4½ lbs.; length 23 ins.; S. 1,377; L. 70; K. 465; H. 880; A. C. 30 ins.—No. 2. 1,348. —No. 3. 1,320.—No. 4. 733.—The Spleen in the Pike is seated in the middle line of the abdomen, upon the lower part of the long stomach, near to the anus; it is of an irregular triangular form, and, as in most fishes, is of a lake or deep purple color; the blood from the Spleen enters the main trunk on its under surface by nine or ten branches, and with that of the intestinal vein partly supplies the liver. A little pigmentary matter under the capsule of the Spleen; a large quantity in the kidney.

44. Gar-fish. *(Esox Belone)*. B. 18 ozs.; length, 22 ins.; S. 880; L. 49; K. 198; H. 880; A. C. large and straight, 15 ins.—No. 2. B. 12 ozs.; S. 252.—Seven veins run from the Spleen to the mesenteric vein, and a large vein passes through the anterior part of the liver, as in the *Ophidians;* the Spleen 3 inches in length, the bones of this fish become of a green colour on boiling.

45. Trout. *(S. fario)*. B. 12 ozs.; length, 12 ins.; S. 792; A. C. 10 ins.

46. Herring. *(Clupea harengus)*. (Six specimens.) Average 800.

47. White Bait. *(Clupea alba)*. B. 50 grs.; length, 2 ins.; S. about 1-1050; A. C. 1½ ins. The Spleen in shape like that of the herring, is seated upon the stomach under the liver. Crystals abundant in the blood, and numerous free nuclei in the Spleen pulp, and in the heart blood.

48. Shad. *(Clupea alosa).* B. 3½ lbs.; S. about 938.

Malacopterygii, sub brachiati —49. Plaiec. *(P. platessa).* 1,173.—50. Sole *(P. solea).* 1760.—51. But. *(P. limanda).* 2,200.—52. Flounder. *(P. flesus).* (Six specimens), proportionate average of Spleen, 958; of liver, 38.

53. Lump fish. *(Cyclopterus lumpus).* B. 2 lbs. 6 ozs.; S. 505.—No. 2, B. 3 lbs. 6 ozs.; S. 1,222; L. 75; K 305; H. 500. The Spleen is of a rounded form, is seated behind the stomach; the splenic vein enters the gastric. On injecting the Spleen with thin white paint, small stellate points, having a mossy appearance, are seen at regular intervals on the surface of the Spleen; these *probably* surround the Malpighian bodies, which are not visible.

Apoda. 54. Eel. *(A. vulgaris).* I examined 12 specimens, weighing from two to seven ounces, and the following is the proportion to the body:—280, 330, 464, 330, 300, 346, 192, 256, 270, 219, 175, 281. In larger specimens the relative weight was greater. No. 13. B. 28 ozs.; S. 949.—No 14. 12 ozs.; S. 480.—No. 3. 29 ozs.; S. 2,126.

The Spleen is placed on the right of the stomach, covered by a fold of the small intestine. The artery, which may be called the cœliac, divides into three principal branches, as in the *Mammalia*, supplying the liver, stomach, and Spleen. The blood leaves the Spleen by two veins at the lower part, and one at the upper; these enter the intestinal vein to form the vena portæ which bifurcates between the two lobes of the liver, and runs to the extremity of each. The Spleen of the Eel, as I have shown in Plate 7, (Pisces E), and Plate 3, is full of dark pigment spots. They are, I think, also in the Spleen-pulp. Those, seated under the capsule, look more like tufts of minute black vessels. They are likewise present in the skin and kidney, and to a smaller extent in the liver. The blood of the splenic vein (one specimen examined), the same as that of the mesenteric vein. A large number of free vesicles (like the nuclei of blood-corpuscles) in both. These are abundant also in the Spleen-pulp and in the kidney. Less numerous in the liver.

Cartilaginous Fishes.—(*Chondropterygii*). In addition to those before-named, I have dissected fresh specimens of the Shark, the Dog-fish, and the Lamprey.

54. Port Beagle Shark (*Lamna cornubica*), caught on the English coast. B. 31 lbs. 2 ozs.; length—root of tail to nose, 3 ft. 1 in.; nose to anus, 2 ft. 2 ins. The viscera, including the alimentary canal, weighed 7 lbs. 4 ozs.; the brain 111 grs.; S. 592 1·370; L. 18,260 1-12; K. large, not weighed; H. 823 1-266. The pancreas weighed 275 grains.

The Spleen is seated on the left side of the Stomach. It is composed of about a hundred and fifty lobes, many of them isolated, and varying in size from a pin's head to a walnut; some are nearly cylindrical, and three or four inches in length; others globular. From the main body of the Spleen, a narrow slip, fifteen inches in length, runs along the duodenum to the pancreas. This slip is composed of small lobules, which expand towards the extremity. The artery and vein run at the posterior part; the former sending to, and the latter receiving, trunks from the lobules. The artery and vein form the chief basis of the lobules on the fore-mentioned slip; the vein is large, and its tributary branches numerous. I have injected the Spleen with size and vermillion; and in some parts, the vessels which appear to ramify upon the Malpighian corpuscles are distinctly seen. (Plate 3). The blood-globules are larger than those of any fish I have examined; the Spleen-pulp is composed of blood-globules of irregular-shaped vesicles, of granules, and of white mulberry-shaped corpuscles. In speaking of the Spleen-pulp of this and of other animals, it should be remembered, that

some of the blood-vessels must be ruptured in obtaining it, and therefore the blood-corpuscles may have been in them, and not in the Spleen-pulp. But we must know more of the exact distribution of the capillaries before this matter can be determined.

56. Dog-fish. *(Scyllium canicula)*. B. 8 ozs.; Lt. 12 ins.; A. C. 10 ins.; S. 9 1-391; L. 154 1-22; P. 9 1-391; K. 10 1-352; H. $4\frac{1}{2}$ 1-782.

57. Lamprey. *(P. marinus)*. As I have said before, I could not find a Spleen in this fish, nor have I been able to discover a nucleus in the blood-corpuscle, which is round, like that of Mammals (with few exceptions). At that time I had only examined specimens in spirits; but the dissection of several fresh fish enables me to confirm this statement, often expressed before by others. In the Lampern and Mixine, which I have also examined (as before stated), I was unable to find a Spleen. It will be important hereafter to investigate thoroughly the anatomy of these animals, and more especially to enquire into the constitution of the blood-corpuscle.

AVERAGES.

¶ Taking the six fishes of different families (five bony and one cartilaginous), three from the first table, the Carp, Flounder, and Eel; and three from the second table, the Wolf-fish, Barbel, and Dog-fish, the proportion of the Spleen, Liver, Kidney, and Heart to the body is as follows—S. 840; L. 68; K. 418; H. 891.

PLATES.

¶ The Spleens of fishes belonging to nineteen different families are represented in Plate 2, *Pisces*. The proportions are reduced *(about)* as under. Fig. 315. Perch, $\frac{1}{3}$.—316. Gurnard, $\frac{1}{4}$.—317. Mackarel, $\frac{1}{2}$.—326. Angler Fish, $\frac{1}{12}$.—327. Grey Mullet, $\frac{1}{2}$.—328. Wolf-fish, $\frac{1}{5}$—318. Wrasse, $\frac{1}{2}$—319. Pipe Fish, $\frac{1}{2}$.—320. Pike, $\frac{1}{3}$.—321. Salmon, $\frac{1}{6}$.—322. Herring, $\frac{1}{2}$.—323. Cod, $\frac{1}{3}$. —324.—Flounder, $\frac{1}{2}$—325. Lump Fish, $\frac{1}{2}$.—329. Balistes, $\frac{1}{4}$.—330 Common Eel, $\frac{1}{4}$.—331. Electric Eel, *(S. America)*, $\frac{1}{2}$.—Dog Fish, $\frac{1}{4}$.—333. Basking Shark, $\frac{1}{8}$.—334. Skate, $\frac{1}{4}$.

Table shewing the relative weight of the thoraic and abdominal Viscera to the Body in the various classes of vertebrate animals, described in the foregoing tables. As some of the larger animals were not weighed, and as the proportions would vary much in different specimens, the adverb, about, *must always be placed before the figures.*

	Number of Specimens	S.	L.	P.	K.	H.	Lgs.
MAMMALIA.							
Bimana		373	41	995	497	248	40
Quadrumana	6	300	23	1058	226	145	84
Cheiroptera. P. auritus .	1	300	24	—	132	88	66
Fruit-eating Bat–Pteropus	1	2273	37	—	133	158	106
Carnaria	6	354	29	658	265	116	64
Marsupiata	5	271	26	—	267	98	87
Rodentia . ... { Rat ...	1	210	26	—	248	178	86
Rodentia . ... { Hare ...	1	2248	47	—	—	—	106
Edentata	3	376					
Pachydermata { Peccary & Tapir	2	216	70	—	328	109	65
Pachydermata { Elephant	1	580	104	—	653	227	48
Ruminantia	4	332	29	—	316	90	36
AVES.							
Accipitres { wild	4	1337	30	817	245	70	89
Accipitres { in confinement	4	1891	51	—	203	128	133
Passeres	4	868	28	400	140	84	71
Scansores	3	1431	25	—	145	60	61
Gallinæ	5	2388	47	1650	184	106	104
Grallæ	3	2308	36	—	179	96	68
Palmipedes	3 }	2899	36	—	—	103	117
Divers		3480	19	820	93	69	59
REPTILIA.							
Chelonia. Turtle	1	804	23	1260	206	259	45
Sauria. Aligator	1	1045	94	3631	627	1045	125
British Reptiles.							
Ophidians. Slow Worm ... ... Snake and Viper ... }	3	2229	31	375	88	216	—
Saurian.							
Sand Lizard	1	960	25	—	—	108	—
Batrachians.							
Toad, Frog & Water Newt	3	1036	30	570	224	197	—
PISCES.							
British Fishes	6	840	68		414	891	

N.B. It must be remembered that the weight of one kidney only is given, and that many of the above animals were living in confinement; but the most healthy specimens were selected.

I intended, as I have before stated in the original Essay, to save the time of the reader by placing before him preparations and drawings, and I will now allude to some of these in the seven plates on the development of the Spleen, using the words there employed. 1. Lamb at birth, Spleen 3¼ grs; Spleen-pulp, consisting of clear, white, un-nucleated cells, blood and lymph corpuscles and granules.—2. Spleen and stomach of a Weasel aged 10 days. The Spleen proportionately larger than in the full-grown animal.—3. The Spleen of a fœtal Rabbit near birth is seated upon the stomach, is of a bright red colour, and consists of a series of vessels, some of them passing from its thin edge to the stomach.—4. Spleen of Mouse aged eight days, the thin edge ill-defined.—5. Spleen of a fœtal Lamb, the size of a walnut. The rudimentary Spleen, placed upon the paunch, consists of a fan-shaped mass of gelatinous material, in which vessels are seen to ramify at the upper part, and to run towards the thin edge, which is not vascular.—6. A Linnet about the 14th day of incubation; a few red spots are seen in the situation of the Spleen, but no distinct vessels.—7. A Sparrow within about four days of hatching. A mass of blastema, in which vessels are seen to ramify; the form of the Spleen imperfect.—8. Flycatcher about the 14th day of incubation; the Spleen like that of the Linnet, No. 6.—9. Linnet two days after hatching; Spleen, a bright red cylindrical body, in the usual situation; vessels are seen passing from it to the gizzard.—10. Spleen of a Blackbird at the full period of incubation, the form and situation as in the adult bird.—10 and 11. The Spleen of a Sparrow and of a Marsh Lark at the last stage of incubation.

All the above are represented with the gizzard in a natural, and in a magnified form (60 diameters). 12. Spleen of a young Starling (nearly fledged) magnified 60 diameters, shewing yellow Malpighian corpuscles, surrounded by vessels and Spleen-pulp.—13 Magnified Spleen of a Sparrow aged 6 days; numerous vascular spots are seen of a roundish form, and nearly equi-distant, on the surface of the Spleen, which has a yellow, gelatinous appearance.—14. Spleen of fœtal Colt at the 8th month of utero-gestation, weighing 1½ oz.—15, 16. The Spleens of two Pigs at birth, weighing 60 and 65 grs.

¶ Besides these, the relative weight of the body and of the viscera of young animals, is given in many of the tables, so that the reader may make his own comparisons; but I have made some additions to these, and will in a small compass give the result. I may premise that the Spleen of many of the young of the lower animals is proportionately larger than in the adult.

The proportion of the Spleen to the body in the subjoined, was about as follows: Vervet Monkey at birth, 502.—Lion at birth, 360.—No. 2, 371.—Pup, 149.—Seal at birth, about 300.—Kangaroo Rat, 124.—Mouse, 150.—Hare near full period, 1,050.—Fœtal Colt, 640, 537.—Calf, 6th month of utero

gestation, 1,408.—Pigs, at birth, 324, 352.—*Birds.* Starling near hatching, 1,300.—Partridge, 670.—Sparrow full fledged, 390.—Finch, 603.—Chicken 5 days, 940, 630.

Reptiles. I have examined many of the young Batrachians of this country, toad, frog, and triton in the tad-pole state, but have not succeeded in finding a Spleen until the extremities are partly developed. A small red spot is first seen in the mesenteric fold; this gradually assumes a rounded form in the frog and toad, and when the young reptile is perfect, the Spleen is nearly of the same shape as in the adult. It is readily distinguished from its bright red colour, and forms a remarkable contrast with the surrounding organs. In the triton, a mass of blastema of an oblong shape is first visible, with bloody spots at irregular intervals, but when the metamorphosis is completed, the organ assumes a regular form, and numerous vessels are observed passing from it to the stomach. In one specimen, a large (comparatively) mass of black pigment was seated at the extremity of the Spleen upon the capsule. This matter evidently forms an important part in the formative process (sanguification). In these young reptiles the pulpy portion of the Spleen consists of well formed blood corpuscles, as large as in the adult, with thinner cell walls; of narrow or shrivelled blood corpuscles, numerous white round corpuscles, free nuclei, and of pigmentary matter in globular masses, and in granules. The kidney and liver, as I have explained, in the adult, also contain all the above-mentioned, but varying in form and quantity in different specimens. *Fishes.*—I have examined the young of the salmon (hatched in tanks), at various stages of development; the Spleen which I have seen on the fifth day after hatching, is a light coloured mass of blastema, which gradually assumes a red appearance from the increase of vessels. The quantity of black pigment in the skin and various parts of this and other young fishes, is very remarkable.

EXPERIMENTS AS TO THE EFFECT OF MEDICINES ON THE SPLEEN.

One of the most interesting and practical questions is, as to the effect of certain medicines upon the size of the Spleen? I have seen M. Piorry, of Paris, give quinine and salt to several patients, percussing the Spleen before the dose, and coming to the conclusion, by careful percussion afterwards, that the Spleen was diminished in size, almost instantly, by the medicine.

The solidity was certainly less (as I thought) after the quinine, or salt; but I attributed the change to the generation of gas by the agent administered. The subjects, six of them were soldiers who had served in Africa, and whose Spleens were probably hard and indurated to such an extent as to defy the power of any medicine, admitting even that it had a specific action upon the organ.

I have made various experiments with quinine, and have come to the conclusion, that it exerts no *immediate* influence upon the Spleen.

Four rats were fed by me upon quinine, sugar, and cheese only, for a week, and, when killed, their Spleens were compared with four healthy rats of the same size; no difference was perceptible in the Spleens, either by the naked eye or by the microscope.

ON THE ACTION OF POISONS AND DELETERIOUS DRUGS ON THE SPLEEN.

It has been asserted that Morphia, Opium, and other drugs, exert a powerful influence upon the Spleen.

I took 30 mice of the same size and weight, and poisoned 5 with opium, 5 with camphor, 5 with Prussic acid, 5 with chloroform, and 5 with tartarized antimony, and I examined them side by side with healthy mice killed at the same time by violence. Those killed by chloroform had darker Spleens. The others were not altered.

I poisoned three sparrows (in July last) with the virus of the rattlesnake. I compared the Spleen-blood with that of three other sparrows I killed by violence; no difference could be perceived.

HUNGER AND REPLETION.

As regards the effects of hunger, too, upon the size of the Spleen, I think there is some error, and that experiments upon a more extensive scale should be adopted. But the Spleen of most animals varies so much in size, that all deductions upon this subject may be erroneous.

Four rats were kept without food for 24 hours, and their Spleens, when killed, were compared with those of two rats that had been well fed; no difference was evident.

A young weasel, half grown, was deprived of food for 30 hours, and then killed; and when its Spleen was compared with that of one of the same litter which had eaten heartily, the Spleens presented the same appearance.

¶ I have performed several experiments since the above was written, to endeavour to come to a more satisfactory conclusion upon the subject; but I am still in much doubt; for in many animals that I have dissected with full stomachs, the Spleen has been unusually small; and in other instances, I have found the Spleen large in half starved animals with empty stomachs.

In *Cruveilheir's* Anatomy, it is remarked, in opposition to the opinion of

Lieutard, that the Spleen is increased in size during the period of digestion; "that four newly-born puppies of the same litter were killed, two of them having been kept without food, and the other two fed on milk; the Spleens were all found of the same size"

Experiments.—Three mice were starved for twenty hours, and three well fed. The weight of the former 271, 272, and 221 grs.; the Spleens about 1.1. and $\frac{5}{6}$. Four were well fed, their bodies weighed 471, 472, 220, and 210 grs.; the Spleens about $1\frac{1}{6}$, $1\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$. So that taking the weight of the body into account, no important difference existed.

Experiment No. 2.—In two half-grown mice of the same litter, one was starved, the other well fed; the Spleen of the former was relatively larger.

Experiment No. 3.—Three full-grown rats were kept twenty-four hours without food, and three of the same size were well fed. They were all killed, as in the experiments above related; in the same manner, the bodies and the viscera were all carefully weighed and examined microscopically, but no difference was perceptible. No white corpuscles were seen in the aortic blood, but three or four were present in the Spleen-pulp, which consisted in all of irregular-shaped vesicles and granules.

In a young pregnant female, the white round corpuscles in the Spleen were twenty times as numerous as the red, and many of them appeared to be granular (containing granules). The only difference between the blood of the splenic artery and of the vein (microscopic) in these specimens was the presence of albuminous flakes in the latter. The relative weight of the livers appeared also to be about the same. The Malpighian corpuscles contained granular matter and vesicles about one-fifth the size of those in the Spleen-pulp.

Experiment No. 4.—Four rabbits were starved for forty hours; their bodies weighed 13 ozs. 120 grs., 20 ozs. 126 grs., and 25 ozs. 10 grs.; the Spleens, 5, 5, and 9 grs. Two weighing 23 ozs. 24 grs., and 36 ozs. 120 grs. were well fed; the Spleens of the former weighed 11, and the latter 19 grs., making a considerable proportionate increase in the latter. The Spleens of the well fed rabbits were plump and red, and the Malpighian corpuscles more distinct; those of the starved, lax and light coloured. The livers and other viscera were weighed, but I have mislaid the note; my impression, however, is, that all the livers were smaller in the starved rabbits.

Experiment No. 5. Two chickens of the same brood, one weighing 2 lbs. $1\frac{1}{2}$ ozs., the other 2 lbs. 1 oz The Spleen of the first, well fed, weighed 20 grs., the liver 325. The latter was starved for 24 hours; the Spleen weighed 21 grs., the liver 324. The bile of the former was of a light green colour, of the latter (starved) of a dark green, thicker and less abundant.

The experiments I had before made were upon a carnivorous and an omnivorous animal. In the vegetable feeders, (judging from the rabbits), the Spleen is considerably diminished by starvation, but more extensive experiments are required to determine this matter, and the weight of the liver *especially* must be likewise estimated. In many reptiles that had not fed for a long time I have found the Spleen of large size. (Crocodiles, *e. g.*)

That the Spleen contains a larger quantity of blood during the digestive process is very probable; for at this period the action of the heart is increased both in power and frequency. The distension of the stomach, moreover, in many animals, straightens and elongates the splenic artery, and thus accelerates the flow of blood to the Spleen and stomach. The elastic structure of the former organ regulates the supply of blood to the liver, whilst the valvular arrangement of the orifices in the splenic-vein, and the presence of semi-lunar valves in the splenic and other tributary veins of the portal circulation in many animals, serve to prevent regurgitation.

But there is another circumstance that, as far as I am aware, has not been alluded to by former writers on this subject, viz.—the relation of the coronary veins of the stomach to those of the Spleen. Some speak as if a part of the blood from the stomach generally passed into the Spleen, but it rarely happens that any direct communication exists between these organs. The coronary veins enter the splenic or its branches, and occasionally in man, and other animals not supplied with valves, the blood of the stomach may regurgitate into the Spleen through the main trunk of the splenic vein. If the arrangement and connexion of these veins are carefully studied, it will be at once apparent that the blood flowing from the stomach must to a great extent retard the current in some of the splenic veins, and that the quantity of blood in the Spleen must be influenced by this cause.

EXTIRPATION OF THE SPLEEN AND ITS EFFECTS.

When I began this enquiry, it was my intention to have extirpated the Spleens of various animals, especially those of horses, sheep, oxen, and birds; not for the purpose of ascertaining whether an animal would live and remain in good health, for this had been fully determined, but with a view to the comparative examination of animals during life and after death; a method, as far as I know, that has never been fairly and properly carried out. I was led to believe, from the writings of many on this subject, that the Spleen might not only be removed with impunity, but that the animal was rather benefited than not by the operation; and in 1835, the late Mr. Eagle advised all farmers to de-spleenise their pigs for the purpose of fattening them more readily: but he hazarded the opinion also, that the extirpation of this organ would be justifiable in some cases of *Phthisis* in the human subject. (*Lancet*, 1835.)

Although I did not subscribe to this opinion, I supposed that this operation would generally be unattended with danger. With this impression, I proceeded to cut out the Spleens of two young pigs, (see Plate 1 E, Ext. of Spleen and history,) but although the operation was quickly and easily done under the influence of chloroform, the animals both died of acute *peritonitis*. I then cut the Spleen out of a pup 8 days old; this also died of intense inflammation of the peritoneum. I now began to ask myself whether I was justified in endeavouring to carry out my experiments on so extensive a scale as I had originally intended? Whether the benefit likely to accrue to science would compensate for the cruelty that must necessarily attend this operation? and I therefore deter-

mined to confine my experiments to rats, cats, and dogs; and the history of the animals, the bodies of which are exhibited in the two large jars, with the drawings of the various structures, (Plates Ext. of Spleen,) and microscopic and chemical examination of the blood, will explain the result of the operations.

Before giving an account of these cases, let us briefly enquire whether any other single organ besides the Spleen, can be removed with impunity? A portion of the brain may be lost, or a part of its structure may be disorganised to a great extent, and yet life may be prolonged for a considerable time:—one lung may be studded with tubercles, or both of them may be otherwise diseased, yet the patient may still linger on:—one kidney may be destroyed, and the other will supply the place of both:—but let the two hemispheres of the brain; the two lungs; and both kidneys be extensively diseased, and how soon (generally) does the patient succumb to the malady. Lesions to a great extent may exist in the liver, (as the tables of the dissections of the lower animals shew,) and yet the animal may appear to be in perfect health. This I have seen in many instances; and a bird (Mandarin Duck, *e. g.*) may have a plumage that would gladden the eye of the naturalist, when its vital parts are tuberculated and rotten; when its lungs are actually mouldy.* A pig may have its lungs full of tubercles, as I have often seen, and still the fat upon its body would satisfy a grazier. But all this only proves the beautiful provision of nature; that power of compensation and adaptation that exists in all animal bodies!

How can we bring the above evidence to bear on the fact, that the Spleen may be extirpated, and the animal, almost from the time of the operation, may remain in perfect health? No other of the abdominal, or thoracic viscera, can be removed without loss of life; and even the extirpation of the thyroid gland, which is supposed by some to bear a great resemblance to the spleen, is generally attended with a fatal result. I saw the fifth man whose enlarged thyroid gland had been successfully removed by *M. Roux*, at the *Hôtel Dieu*, Paris; the four other patients died after the operation.

* I have frequently found the sporules of mould in the lungs of birds soon after death, and once in the peritoneal cavity.—*After note.*

History of four Dogs of the same litter, fed and treated exactly in the same manner, in two of which the Spleen was removed.

Out of a litter of ten pups (the mother an Irish Setter, the father a Retriever), I rescued four from death by drowning, Carlo, Don, Fan, and Juno, or for the sake of brevity. 1, 2, 3, 4; two dogs and two bitches.* On the 7th of June, 1852, I removed the Spleens of the bitches, when they were 8 days old, under the influence of chloroform; both *appeared* to be killed by the chloroform, and I believe that they were only saved by plunging them into cold water. I omitted, after the operation on No 4, to sew up the abdominal muscle before closing the integuments; a circumstance of no moment as regards its immediate results, but one which ultimately, as will be seen, caused the death of the animal by strangulated Hernia.

Nothing remarkable was observed after the operation, except that they whined more than the rest, and appeared to be in pain, their bodies too were a little swollen. It was curious to see the great care the mother took of these pups; she licked their wounds, and placed them where they were least interfered with by the others, (8 in all). The wounds soon cicatrised, and these pups appeared to be as well as the other two, (the remainder at this time, 14 days after the operation, having been killed.) No. 4, had a puffy tumour over the wound, from the above-mentioned cause.

These pups were at a farm-house, in a healthy situation, and all fed on the same food, viz.: Milk and Barley-meal, besides their mother's milk. They were all kept together, and as dogs of this breed usually do, shewed great sagacity. The pup No. 4, (spleenless), was the most active and intelligent; it was the first to fetch bodies thrown into the water, and it possessed (although the smallest), more courage than any of the others. Its fate is described on Plate 2 E, (Extirpation of Spleen), where the weight and appearance of the viscera are given; for the representation of the parts, see this Plate and the Preparations.

On the 16th of September, the weight of these puppies was—No. 1, 33½ lbs.—No. 2, 27 lbs. 12 ozs.—No. 3, (spleenless),

* The weight of No. 1, 2 lbs. 6 ozs.; No. 2, 2 lbs. 3 ozs.; No. 3, 2 lbs.; No. 4, 2 lbs.

26 lbs. 8 ozs.,—and of No. 4, (spleenless), then dying from the effects of strangulated Hernia, and much emaciated, 14 lbs.

I now confine myself to the histories of Nos. 2 and 3. (Dog and Bitch, with and without Spleen). I selected these as they were about the same size. A relative of my own, a gentleman of great observation and intelligence, sent me the report from time to time, and I supplied him with a thermometer, (medical), to take the temperature, and the blood and excrement were often sent me by post. After repeated observations, I could perceive no difference in the blood, (see Plate 5, Ex. of Spleen, E); and the temperature, respiration, heart's force and frequency appeared to be the same. The gentleman alluded to, used various experiments to try their comparative power of endurance, he could, however. perceive no difference between them: on the 16th of September, I put this matter to a more conclusive test:—they were out with me (when shooting) during a hot day, (from 10 'till 6), with their mother, and shewed neither distress nor fatigue at the end of the day: the only difference I observed in them was, that the bitch was the faster of the two, and therefore, went over more ground; she did not appear to require more water than the other. A gentleman who had them out several times after this, gives the same report.

On the 3rd of November, these pups were sent to my house in Parliament Street, Westminster; the dog, originally the heavier of the two, weighed now 32 lbs.—the bitch (spleenless), 35 lbs. They were fed on all the dog's-biscuits and milk they would eat, and on the 7th of December, the dog weighed 35 lbs., the bitch (spleenless), 45 lbs. Up to this time their food had been barley-meal, dog's-biscuits, and milk. On the 7th of December, I gave them animal food only, which they ate to the time of their death, December 25th.—The dog then weighed 32 lbs.;—the bitch (spleenless), 45 lbs. They were always treated exactly alike, both as regards food and exercise; during the day they were kept generally in a damp vault, and at night brought into a dry kennel. Strange to say, when they first arrived the dog appeared to suffer from the effects of his change of atmosphere; he refused his food;—was feverish—restless—his pulse was quick; and I was obliged to remove him for a few days

into a dry place; he recovered in three or four days. The bitch (spleenless), never appeared to be affected by the damp and cold. I frequently up to the time of their death, examined the excrement, urine, temperature, respiration and circulation; and I could perceive no difference. The dog was more courageous than the bitch; but it must be recollected that the bitch (spleenless), before named, was the most courageous and active of the four.

December 26th, 1852.* These dogs were killed in the following manner—Chloroform was administered, and when they became insensible, a pint of blood from the carotid artery of each was allowed to flow into a stoppered bottle—the bottles being full.

There was a curious circumstance respecting the bitch (spleenless), which I think worthy of notice, although it is difficult to connect the occurrence with the loss of the Spleen. This animal after losing a large quantity of blood appeared to be dead, but after a few minutes the lips moved, and she began to sigh. Wishing to kill her instantly, I poured about a drachm of Prussic acid down her throat, and it appeared to produce instant death; to our surprise, however, she again began to gape, and I poured more acid down her throat; but three or four minutes elapsed before she died. The acid was of *Scheele's* strength, and I had tried experiments with it before, when rats and mice were killed instantly.

This isolated fact is of little value, but the question respecting the cause of this peculiar tenacity of life, whether depending on the absence of Spleen, the loss of blood, or the administration of Chloroform, is one of great interest. One fact is certain, from this and other experiments, that spleenless animals bear the loss of blood as well as those in a normal condition.

Appearance on dissection —After removing the skin of the two, I examined carefully the absorbent glands at the groins and axilla, and no perceptible difference was observed. The body of the bitch was covered with white soft fat, (but little or no stearine); that over the chest was an inch in thickness, and on the back and loins nearly as thick; on the dog about half the quantity was present; but to shew that the increase of weight did not depend entirely on fat, I removed the neck and head near the sternum, the two

* The weight of No. 1, is now 50½ lbs.

upper and lower extremities, and the trunk of each weighed 15 lbs. The muscles of the bitch were more developed than those of the dog.

The parotid and thyroid glands as the Preparations 171, 172, 173, 174, shew, were of the same size. I now give the comparative weight,—appearance to the naked eye, and microscopical appearances of the various organs. The blood, excrement, and temperature, &c., are given in Plate 5, (Extirpation of Spleen, E).

Bitch without Spleen.

A large quantity of fat in the abdomen; gall-bladder distended with bile; all the viscera as regards structure, in a normal condition. The mesenteric glands very large, several near the stomach of great size, as represented in the drawing (Plate 6 E, Ex. of Spleen). For microscopical examination of Liver, Kidney, Thymus, Lymphatic glands and chyle, see the same Plate. A vein under the situation of the spleen running in the direction of the splenic vein, attached to a mesenteric gland as large as a nut.—(See Microscopic examination of blood.)

Dog with Spleen.

All the appearances described on the other side were observed in the dog, as the drawings and preparations shew. I was assisted in the examination by my friend Mr. Adkins; and after a most careful and rigid investigation, putting the two bodies together, and placing every part under the microscope, we could perceive no difference in the structure of these animals. The heart of the dog, (as is seen in the preparation) is remarkably large, its circumference two inches more than that of the bitch.

For Microscopic appearances see Plate 6, (Ex. of Spleen E), and for the Microscopic Preparations of the Blood, (Pps. 47, 48, 49, 50.)

The blood before mentioned was taken by Dr. B. H. Paul, who was for several years a pupil of Lebig's, and who has been solely occupied in Analytical Chemistry. The subjoined is his report:—

RESULTS OF THE EXAMINATION OF TWO SPECIMENS OF BLOOD MARKED B. AND D.

	Bitch without Spleen.			Dog with Spleen.
¶ Bottles and Blood weighed—B. ...	14,036.4	...	D. ...	15,157.6
Bottle ..	4,798.0	...	Bottle.	5,020.0
Blood ..	9,238.4	...	Blood.	10,137.6
Bottle filled with water, weighed—B.	13,520	...	D. ...	14,620
Bottle.	4,798	...	Bottle.	5,020
Water.	8,732	...	Water.	9,600

Consequently the specific gravities of each were about:—

B. = 1,058		D. = 1,056		Water = 1,000
Moist coagulum, B. weighed	4,935.0	=9,238.4	D. 4,555.0	=10,137.6
Fluid part ,,	4,303.4		D. 5,502.6	

Proportion of coagulum by weight ... B. 535 in 1,000 D. 458 in 1,000

The clot of B. was considerably more bulky than that of D. It appeared to contain a larger quantity of the blood cells; the liquid part was paler coloured. 1,000 grains of each coagulum, when (moist) pressed, washed with water until colourless, then treated with alcohol, acidulated with sulphuric acid, with pure alcohol, and with ether, gave residues of fibrine, which, dried in a water-bath, weighed:—

B. ... ... 9.358 grs. D. ... ... 10.728 grs.

Multiplied by the respective weights of the coagula these numbers give:—

9.358 4.935=46.1800. 10.728 4555.0=48.8296.

B. ... 4.999 in 1,000 parts blood. D. ... 4.816 in 1,000 parts blood.

With regard to the points on which data were required, the specific gravity, the proportion of clot, the per centage of fibrine, there does not appear to be more difference between the bloods B. and D. than between any two different specimens.

An experiment to determine the quantity of blood-cells and albumen could not be completed by the time the report was required.

B. H. P.

In Plate 2, (Extirpation of the Spleen), I have figured the abdominal viscera of the prep. No. 4 that died of strangulated Hernia; the intestine passed through the opening of the abdominal muscles, (left after the operation) became strangulated, and an artificial anus was formed. The dog was taken ill on the 1st of September, and died on the 16th; it might probably have been saved by operation. Previous to the strangulation it was in excellent condition, and was the most sagacious, active, and courageous of the four. I examined the body a few hours after death, the subjoined is the weight and appearance of the various organs. Body 14 lbs. (it had rapidly emaciated); liver 9 ozs. 360 grs., sound and natural; the bile, apparently normal, is seen in the next plate, also the blood and absorbent glands; kidney 424 grs.; pancreas 340 grs.; heart 2 ozs. 120 grs.; lungs 3 ozs. 220 grs. As far as I could judge, there was nothing remarkable in the appearance of any of the viscera; I had not time for microscopical or chemical examination. The glands (size of) in the next plate can only be judged of by comparison with the prep. No. 2. From the subsequent examination of other dogs, I find that these were not larger than natural.

EXTIRPATION OF THE SPLEEN OF RATS.

These animals bear the loss of the Spleen, or rather the effect

of the operation, with less impunity than cats and dogs; a circumstance, I think, partly accounted for (as in the pig) by the greater necessity they have for taking food. They also bear confinement badly;—this may be another cause of the greater fatality of the operation among them.

Of the 6 rats I operated upon, one was killed by its companion, two died of acute peritonitis (some days after) from no evident cause. One (a female), whose body is in the bottle (Prep. 186), I killed a month after the operation; the male rat, in the same bottle, was put to this a fortnight after the removal of the Spleen, but she was not impregnated. They were fed upon the same food (bread) up to the time of death. The only difference we observed in the examination of these rats was in the spleenless one, a hard, pear-shaped, absorbent gland, the size of a small nut, near to the cicatrix; but the reader may examine the preparations, and judge for himself. For the history of kittens, see Plate 4 E (Extirpation of Spleen).

In Plate 1, (Extirpation of the Spleen), the Spleens of two pigs that I removed June 8th, 1852, are represented. The pigs were about ten weeks old, both died of acute *peritonitis;* one, two days after the operation, the other lived five days. I watched them frequently, and examined their blood, the excrement, their temperature and circulation, about which, with the exception of the usual results attending peritonitis, there was nothing remarkable. The peritoneum in both was very red, and the folds of the intestines were glued together with lymph. Soon after the operation, the man, contrary to my orders, gave them food, which probably occasioned their death. The blood of the splenic artery and vein, as shewn by the drawings, presented no perceptible difference.

Conclusions from the above Evidence.

1st. That the operation for the removal of the Spleen is one generally attended with some danger to the life of the animal from the effects of *peritonitis.*

2nd. That the assumption that the lymphatic glands, the thymus, thyroid, and supra-renal capsules (all or any of them) perform the office of the Spleen when this organ is removed, is one not founded on careful reasoning and experiment.

3rd. That when the glands in the neighbourhood of the Spleen are enlarged (as in Prep. 180) after the operation, the enlargement is probably a consequence of the irritation of the wound, and not the result of compensatory action.

4th. That animals, as stated by *Shultz*, (Veterinarian, 1845), whose Spleens are removed, are more active and run faster than those which have the organ entire.

5th. That the functions of the body (as far as can be ascertained) are well and perfectly performed after the removal of the organ.

6th. That neither in the blood, nor in the parts formed by it, can any abnormal change be detected as a consequence of the operation.

EXTIRPATION OF THE SPLEEN, WITH THE PARTIAL RE-FORMATION OF THE ORGAN.

¶ My friend and colleague at the Metropolitan Dispensary, Dr. Leared, in October, 1853, gave me a dog from which he had removed the Spleen more than two years before. The following are the notes kindly furnished by Dr. Leared.

"My note-book informs me that the bitch at present in your hands, had her Spleen extirpated July 8th, 1851. She was then seven weeks old. She is a cross breed between a Water spaniel bitch and a Greyhound. She was under the influence of Chloroform when I operated upon her. I made the incision close to the last left rib, carefully detaching the Spleen with my fingers. This plan I thought preferable to cutting, having observed the hæmorrhage to be very profuse in the case of another puppy, which did not long survive the operation.

"I find the following entries at subsequent periods :—July 9th.—Suckles well; able to run about. July 10th.—Separated from mother,as the sutures appeared to be disturbed, from her constantly licking the wound.

"September 30th.—'Spleen,' which is the name she recognizes—*Lucus a non lucendo*, has just recovered from a long and very severe attack of mange, which has left her in a very bad condition. She is however lively and playful, but seems constrained when she attempts to raise herself on her hind legs. Appetite good, but not ravenous. She is much smaller than a sister which I gave away that has not been operated on, the food of both being similar. 'Spleen' was however originally the smallest of the litter. Extreme timidity has been from the first a striking characteristic of 'Spleen.' After mature acquaintance however she has always evinced strong attachment to particular persons."

I kept this dog for several months and tried various experiments, which I need not now detail. I showed the animal at the Physiological Society, as a spleenless dog, but as the report of the examination will shew, the name "Spleen," was not so inappropriate as Dr. Leared supposed.

The animal was removed to the country, and Mr. Gorham, of Aldborough, and Mr. Arnold, Veterinary Surgeon, of Leiston, Suffolk, assisted me at the examination. The body weighed 47 lbs.; the Spleen (its situation natural) 2 ozs. 300 grs.; Pancreas 1 oz. 380 grs. Other viscera also of their normal size and structure; Alimentary Canal 17 ft. 5 ins. Had examined the dog

five hours before death, and spermatorrhœa were observed in abundance in the cornua of the uterus.

The Spleen in this instance was nearly all reproduced, very small fragments only, which were attached to the vessels having been left. Dr. Leared tells me that he preserved the Spleen in spirits for a long time. It is more than probable that in all instances on record of supposed reproduction of the Spleen, that small portions of the organ were left as in this case.

The weight of the Spleen has been already given; its length is 7 inches; its average width about $1\frac{3}{4}$ ins. The Malpighian corpuscles were very distinct. On a careful microscopical examination of these and of the other structures, no difference was observed between them and the same parts in other dogs. At the lower edge of the Spleen there are two large cicatrices covered with dense parchment-like membrane, and the Spleen has evidently grown and been reproduced from these parts. The blood-vessels are in their normal situation.

In a note received from Dr. Leared, since the inspection of the body, he says, "I got the organ away entire with the exception of very small fragments adhering to the vessels, and I had the Spleen for a long time preserved in spirits." I had the advantage of Dr. Leared's assistance in the examination of the Spleen.

The case affords another illustration of the *comparative* unimportance of this organ, for I apprehend that no other large viscus would have been reproduced under like circumstances.

In the "*Gazette Médicale de Paris*," June 9, 1855, p. 367, there is an account of the examination of a dog which had its Spleen removed six years and six months before its death, which occurred from an epidemic disease that destroyed many dogs in the same district. From the time the Spleen was removed up to the period of the accession of the epidemic disease, its health had been excellent. A few months after the removal of the Spleen, it was placed with a bitch, which produced the usual number of pups. M. Vulpian examined the blood under the microscope a few days before death; the white corpuscles were of the usual appearance, and on comparing this blood with that of another dog, the number was found to be the same. The autopsy revealed the following;—Lungs of their ordinary volume, also the thyroid gland; the heart very large, the left ventricle being hypertrophied; the liver normal both in volume and structure (as compared with that of other dogs); there was no vestige of a Spleen. The splenic artery on the superior border of the pancreas divided into two branches; one small, the other almost as large as the main trunk, passing to the stomach, and forming the left gastro-epiploic; the other branch terminated in five short branches to the greater curvature of the stomach; these arteries were all accompanied by veins. The kidneys and supra-renal capsules were normal, the lymphatic ganglions of the mesentery, as well as the inguinal, were hypertrophied. A microscopical examination of the blood of the principal vessels was made with great care; seven or eight hours after death. The red globules had their borders serrated, and their edges curled *(recoquillés,)* the white globules were intact. The blood contained a tolerable number of white corpuscles; these were rather more numerous in the vena cava, and in the spermatic veins. This dog was fed exclusively upon raw flesh."

I may repeat in conclusion, that it is quite evident, as shewn by the forementioned cases, that the Spleen can neither be exclusively a blood-forming, nor a blood-destroying organ, and that the other ductless glands, judging from their size and form, and the nature of their contents, do not supply the office of the Spleen; and that a rigid microscopic examination of these glands,

does not warrant the assumption that their structure is identical with that of the Spleen.*

MONSTROSITIES.

I have not been able to examine so many of these as I intended; but in seven kittens, three of them, double above and single below; two single above and double below; one with six feet, and one with a rudimentary kitten attached to the naval; nothing abnormal was observed. In the Preparation 149, a kitten with two heads, the Spleen is normal.

The most interesting examination I have made of a monster, was with Dr. Bristowe. The child born at the full period, double body and one spinal column, with one abdominal cavity, two stomachs, one liver in the centre, and two gall-bladders. A well developed Spleen was seated on the left of the stomach, in the usual place; but the only thing seen on the right side was a small body, close to the right stomach.

* ¶ I have again examined with great care the bodies of the dogs, (preparations 171, 172, 173,) and if there is any difference, these ductless glands are larger in the dog with the Spleen, than in the one without it.

PATHOLOGY OF THE HUMAN SPLEEN, AS ILLUS TRATING ITS PHYSIOLOGY.

On looking over the notes of the examination of above 200 bodies that I have inspected myself, or have been present at the autopsies, I find very few remarks concerning the state of the Spleen; indeed, in the vast majority of cases, it has been superficially examined, and in some instances it has not been inspected at all, so that this evidence is of little use in determining the abnormal conditions of the organ.

Among the notes of the above cases I may briefly mention the following; —In several examples of typhus fever and malignant scarlatina, the *Spleen* was soft, dark, and pulpy, (I speak of *these* cases generally from recollection,—of the others, from notes). In one instance of extreme typhus, under my care, the liver is described as very large and congested, —the Spleen double its natural size and full of grumous blood —*Male*, æt. 68. Malignant disease of the pylorus;—the Liver tuberculated, the Spleen, Pancreas, and Kidneys, healthy.—*f.* 30. Tuberculated lungs and peritoneum; the tubercles confined to the peritoneal covering of the intestines. Spleen sound.—*m.* 30. Acute Abscess of the Liver. About two pints of greyish coloured pus; the surface of the organ covered with lymph (recent). The Spleen very small and soft.—*f.* 35. Liver double its natural size, firm; simple hypertrophy; Spleen normal.—In several cases of tuberculated liver the Spleen was free from tubercle. The case No. 1, of hypertrophy of the liver and Spleen, with diseased blood, is the only one among the above of especial interest, and it was the case that first led me to think more about the pathology of the Spleen.

During the present investigation, however, I have examined the 50 Spleens described in the Table (and of all of which drawings are given) with great care, and if the general amount of abnormal structure can be estimated by these few cases, the changes in this organ are greater than has been hitherto supposed. I may observe, however, that nearly all the persons from whom these Spleens were taken, were in the lower ranks of life, and many of them the inmates of an hospital, or a large poor-house; some of them also, were of dissipated habits, and had been exposed to want and privation.*

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* For the condition of the Spleen in these cases, I refer the reader to pages 52—56.—*After note.*

The subjoined report has been kindly supplied me by my friend Dr. Bristowe, who for three years has examined all the bodies at a large Hospital, (St. Thomas's), and has taken notes of the morbid changes (1852).

Male, æt. 27. *Phthisis, empyema;* fatty liver; fibrinous deposit of Spleen.—*f.* 12. *Phthisis* and scrofulous disease of hip and knee-joint. Spleen studded throughout (thickly) with small well-defined circular bodies, having a clear translucent appearance, and about the firmness and colour of miliary tubercles.—*m.* 32. Gangrene of toes; pulmonary apoplexy. Softening clots in left ventricle of the heart; cartilaginous thickening of the capsule of the Spleen, as large as a five shilling piece, and two or three times as thick.—*m.* 41. *Phthisis;* ulceration of intestine, and tubercular deposit in mesenteric glands.—*m.* 45. Cancer of Spleen, and encephaloid cancer of left kidney. The Spleen was imbedded in this large tumour; and the cancerous growth extended a short distance within the *hilum* of the Spleen.—*f.* 26. *Phthisis;* fatty liver; intersusceptio. Spleen large, pale, and soft; numerous yellow tubercular spots as large as pins' heads scattered in its substance.—*f.* 35. *Phthisis;* tubercles in left Fallopian tube; ulceration of cæcum. Spleen firm; of its natural size; thickly studded with greyish transparent granules.—*m.* 9. Tubercles in lungs, liver, spleen, and kidneys. Pneumonia; incipient hip-joint disease. Spleen closely studded with small transparent granular bodies, probably miliary tubercles.—*m.* 27. Extensive tubercular deposit in lymphatic glands of lungs, intestines, &c. Spleen of ordinary size and consistence; in its posterior part were several irregular masses of tubercle, varying between a bean and a mustard-seed in size.—*f.* 67. Dry gangrene of foot; arteries of leg and thigh ossified; splenic artery ossified throughout; Spleen small and natural.—*m.* 73. Diffuse cellular inflammation of hand; hydatid cyst of Spleen partially ossified (preparation in the Museum).—*m.* 12. Tubercle in brain, lungs, and peritoneum. A small softening patch of tubercule in the Spleen; the organ otherwise healthy.—*f.* 26. Tubercle in peritoneum and lungs; *cirrhosis.* Spleen large and soft; several deposits of tubercle as large as a pea or tare—some larger ones softening in the centre.—*m.* (elderly), died in a fit of serous apoplexy; slight miliary deposit of tubercle in lungs. Spleen adherent and soft, presenting two or three cheese-like tubercles as large as tares.—*f.* 24. Tubercles in lungs, ovary, and Fallopian tubes; small tubercular deposit in Spleen.—*m.* 25. Inflammation of lungs and pericardium; enlarged liver; jaundice; fibrinous deposit in kidneys. Spleen increased in size, 9 inches long, and other diameters proportionate; rather firm.—*f.* 26.

Peritonitis cirrhosis ; old tubercles in the lungs. Spleen large, 9 inches long ; structure palid and soft.—*m.* 59. Cancer of stomach. Spleen adherent to cancerous stomach, and cancer encroaching a little on the substance of the Spleen through its *hilum.*—*f.* 26. Cancer of stomach, liver, ovaries, and peritoneum. A similar case (as regards the Spleen) to the above.

¶ Dr. Bristowe's great attention to Pathology, and his zeal in the prosecution of Medical Science, give greater interest to the above cases, which are given without comment.—*After note.*

In the Reports of the Medical Missionary of China, 1840 to 1849—I find, out of 984 diseases of the abdominal viscera, that 117 were diseases of the Spleen, the localities being Macao, Canton, and Amoy.

Dr. Daniell, in his Sketches of the Native diseases of the Gulf of Guinea, (Western Africa,) 1849, says (p. 180), " Organic lesions of the liver and Spleen, and that most intractable and fatal of all African diseases, dysentery, are often met with. Enlargement and hepatization of the Spleen, being one of the more constant sequelæ of remittents, and other febrile diseases are not rare."

M. Aubert, in his beautiful work, " *Clinica Iconographia, Medico-Chirurgica,*" *B.* 21. Tome 11, published at Moscow, 1848, in speaking of the epidemic yellow fever, (*Typhus Icterodes,*) which carried off 2,000 of the population of Moscow, between October, 1840, and November, 1841, says, " that when the mortality (in the middle of winter) was the greatest, the inhabitants were free from all sources of malaria. M. M. Pelican, Sampson, and himself, found in numerous inspections the Spleen putrid (*putridus*), and often tuberculous and purulent. M. Aubert believes that the first-named condition of Spleen, and not the disorganization of the liver, as many supposed, was the cause of the fever, as the disintegration above mentioned was constant."

PHTHISIS.

Louis found tubercles in the Spleen of 7 out of 90 patients. In these 90 the size of the organ varied much ; in 15 it was much less than natural; in 16 much greater ; but he could trace no connexion between these enlargements and the previous intermittent fevers, for in several who had laboured under intermittent or continued fevers the Spleen was very small. The consistence was increased in 10 patients, and this was generally accompanied by enlargement and friability. In 8 the softening was as great as in typhus fever ; of 64 other phthisical patients, 6 had tubercles in the Spleen, and in 5 of these the liver was likewise

tuberculous. As a contrast to the above, he speaks of 160 autopsies of persons affected with various diseases, including typhus fever:—the Spleen was small in 50; in 26 who had died of Pneumonia or heart disease, the decrease of size was very remarkable. No tubercles existed in any of the last mentioned (160) cases."

The Table of 136 cases of Phthisis in which the Spleen and Liver were weighed, and their conditions, with that of other organs noted, gives the following result (see page 59). Average weight of Spleen 6 ozs. and a fraction: the liver generally larger than natural. Of these cases, tubercles were only observed in the Spleens of three. Further on I have added, forgetting the above paragraph, and at this period (from want of time) having only looked down the columns of the table without calculating the relative weight of the liver:—"One of the most interesting and conclusive facts connected with Pathology in this Essay, is the circumstance respecting the 136 cases of Phthisis, in which the liver and Spleen were weighed and examined; that the weight of the Spleen did not average more than 6 ozs. and a fraction, while that of the liver was much increased, shewing that the Spleen, as considered by some, cannot be a supplementary liver."*

The cases of hypertrophied Spleen in the human subject, drawings of which are given, serve to show that the condition of the liver has more to do with the formation of white corpuscles than the Spleen; and I believe the appearance (generally) of these corpuscles, in some cases of hypertrophy of the Spleen, to be rather a coincidence, and that it does not necessarily depend on the splenic enlargement.

Want of time compels me to close this interesting inquiry, without drawing the Physiological deductions which I originally intended. There is one pathological fact that should not escape notice, viz., that in malarious districts, where the circulation of the blood is deranged, and when, for a long time, it is driven into the interior, the Spleen becomes often congested and enlarged, and is so engorged with blood, that its trabeculæ, by gradual stretching, lose their elasticity, and permanent enlargement is thus engendered. The hypertrophy, in many cases however, not producing any material effect on the functions of the body.

¶ * In this estimate the weight of the body, which is considerably reduced in *Phthisis*, should have been taken into account, and then the relative weight of both organs would have been found to be considerably increased, and the liver *generally* much larger than natural; its weight in several instances reaching from 60 to 80 ounces. As a general rule, where the liver is much increased in size, the Spleen is also larger; but to this rule, speaking of the table in question, there are numerous exceptions.—*After note.*

The subjoined cases were in the Appendix to the Essay, and I have added two others, related under the drawings of the human Spleen.

CASE I.—*Enlarged Liver and Spleen, with a remarkable appearance of the Blood.*

Jan., 1846.—I examined, with Mr. Bristowe, of Camberwell, 24 hours p.m., the body of Mr. ——, innkeeper, æt. 45; he had been in a declining state of health for some time, and had consulted many medical men; he was supposed to have abdominal tumour, but its exact nature could not be ascertained; his appetite, until lately, very good; habits, not intemperate; never had ague, but had been in an aguish district for some years before. The enlargement was generally supposed to be confined to the liver,—not the Spleen.

Chest.—Left lung, small and collapsed, right, large and emphysematous. Heart.—Normal, as regards its structure, but the blood in the right auricle, which was distended, presented a very curious appearance; the coagulum looking like softened liver; it was of a brickdust colour, the red particles being interspersed with white granules. The right ventricle also contained some of this blood. The liver weighed 10 lbs.; the Spleen, 8 lbs; both these organs softened, but not materially altered in structure. On cutting into them, a large quantity of grumous, brickdust-coloured fluid escaped; this had a faint, unpleasant smell. Kidneys, healthy; all the large arteries free from disease. At this period (1846), I had not used the microscope much myself, and could not depend upon my own examination. I forwarded some of the blood to a gentleman (Dr. Gull) much accustomed to microscopic examinations, and I give the report in his own words. "I found the blood to present by no means the usual appearance, which might, however, be in some degree owing to the time which had elapsed since death. The particles were larger than usual,—and this uniformly; they had, moreover, what seemed a very definite nucleus and dark spot, or nucleolus; this giving to each corpuscle a very different character to that usually presented."

¶ *Remarks.*—This case bears a great resemblance to the one (Case 1, p. 8) in Dr. Bennett's work on *Leucocythemia*, in which the same kind of coagulum existed in the veins.—(See Plate 1, of Dr. Bennett's work). "The blood globules in Dr. Bennett's case, varied in size from the $\frac{1}{80}$ to the $\frac{1}{200}$ of a mill: and resembled pus-globules; they were colourless, granular, and round; and acetic acid produced a distinct nucleus."

CASE II.—*Enlarged Spleen, white Liver, white Blood.*

Plate 7, fig. 21 E, shews the Spleen and part of the liver and bile of

a child that had been under my care for several weeks at the *Metropolitan Dispensary;* its age 10 months. The mother had had ten children, and they all died about this age with nearly the same symptoms, viz.: anæmia, with want of power without any apparent cause. The child's face was as white, almost, as this paper, and it gradually sunk; pain, as far as one could judge, was never present. I examined the body with great care; the left lung was covered with old fibrinous deposit, and the pleuræ were adherent throughout; the Spleen larger than natural, but apparently healthy in structure. The liver, (fig. 2,) was white (like that of a fish), and the bile, (fig. 1 E,) very thick and *treacly*: it contained numerous dark coloured granules; other organs sound. I could not learn that there was any cause for the mortality of these children, either connected with the locality, or with hereditary disease. A child since born has died under my care with the same symptoms, but unfortunately I could not obtain a *post mortem* examination. The condition of the liver and bile, I believe, was the origin of the anæmia in this case, and probably in the other children also; the blood corpuscles as represented in the sketch were large; the splenic vein contained small globules, a little like fat globules; the blood globules were very light coloured; the bile thick, and of a dark green colour as shewn on the paper.

CASE III.—*Hypertrophy of the Spleen in an Infant. Purpura Hæmorrhagica.*

My friend, Dr. B. W. Richardson, has supplied me with the under-mentioned case; he sent me also the Spleen and liver soon after the examination. The parts were in spirits, so that I could not examine the blood. (See Plate 7 E., and Prep. 144).

"The child had bad health from the time it was born. Soon after birth, the abdomen began to enlarge, and the body became emaciated; a previous medical attendant had diagnosed enlarged Spleen. Eight months afterwards, the symptoms of *Purpura* commenced, and bleedings from the nose were frequent. He was treated with cod liver oil and good diet, and was sent into the country for change of air. He came under my care only on the last day of life,—one year and fifteen days after birth. He was then suffering from continued fits of syncope, one of which proved fatal.

I opened the body 24 hours after death; no cadaveric rigidity. Body, very pale and emaciated, and covered with purpuric spots, some as small as a pin's head, others as large as a sixpence. Brain, large and pale, but healthy in structure; a small loose clot of blood lay on the left cerebral hemisphere, together with a small quantity of serous fluid. Lungs, normal,

but pale and full of air. Heart firmly contracted, and healthy in structure, but pale. On the right side (in the auricle) there was a large sized fibrinous clot which filled up the cavity, and sent prolongations into the inferior and superior vena cavæ. Liver large, Spleen large, and very red, and dense in structure; it weighed, in its fresh state, 9 ounces. Mesenteric glands rather large. Gall-bladder full of bile; other organs quite natural. The child had not lived in a malarious district."

CASE IV.—*Hypertrophy of the Spleen.*

Dr. Richardson, has likewise furnished me with the following, and he sent me the Spleen (Prep. 145, Plate 28 E,) soon after it was taken from the body.

" The subject of the disease was a woman, fifty-five years of age, the mother of several children, who had been ill for some time; but as she was on a visit to her daughter, who left soon after her death, but little could be ascertained of her previous history. The existence of an enlargement of the abdomen had been discovered, but it was not supposed to be hypertrophy of the Spleen. She had had ascites, and the secretion of urine was scanty; she was much emaciated, and died apparently from asthenia.

" On examining the body, the Spleen was found to weigh $3\frac{1}{2}$ lbs. It was firm, and its surface covered with patches of lymph, and so pressed upon the left kidney as to diminish its size considerably; the right was of the usual size. The liver, and the rest of the abdominal viscera, normal; the heart healthy, but small and empty; the left pleura contained about three pints of serum; brain not examined."

¶ The blood of the splenic vein, as shewn in the drawing (Plate 28 E,) contained no white blood corpuscles. Large patches of dense yellow lymph were seen on the surface of the Spleen, and several in the interior. The slice of Spleen represented shews a mottled surface, produced by infiltration of yellowish lymph. The absorbent glands were the size of large nuts. (See Plate 1, fig. 25 of this Treatise). The branches of the nerves appeared to accompany the smaller arteries, and to be lost in the Spleen substance. The trabeculæ less distinct than usual. *After note.*

CASE V.—*Hypertrophy in the Spleen of a Child two years of age.*

My friend, Mr. Ebsworth, has kindly given me the particulars of the following case; he sent me the Spleen and some of the intestines, immediately after the examination. The drawings, (Plate 8, E,) represent

the Spleen and other parts, and Preparation 135 is the Spleen itself in spirits.

"The Spleen was taken from a child two years and three months old, who had been suffering for the last seven months with all the symptoms of *gastro-enterite;* wasting of the limbs; difficult dentition; and a perfectly anæmic condition of the whole body, more particularly induced by hemorrhage from the nostril, which took place *three* times; the last to such an extent as to *destroy life.* The first bleeding was occasioned by the irritation of a worm, which descended the nostril; and so was the second; but the last bleeding came on spontaneously. Throughout the illness, the intestines poured forth the most fœtid, dark, grumous secretions, and they never recovered their proper functions. The appetite of the child was enormous when partial recovery took place, but the food never appeared properly digested.

"Three months since the abdomen became distended, but not with fluid; and on the left side I noticed a hard, firm tumour, perfectly circumscribed, extending from the left hypochondriac to the left iliac region. I distinctly referred the tumour to the Spleen; the Liver was enormously large *also.* The mother remarked to me, when the child bled so much, that the abdomen rapidly diminished in size; this might be expected, for nearly a pint of blood was lost on each occasion.

"I opened the body three days after death; it was much emaciated, and the surface exsanguine. The Lungs were consolidated and impervious; the Heart pale and contracted in size. The Liver took up $\frac{2}{3}$ of the abdominal cavity, and the Gall-bladder was full of unhealthy bile; the structure did not appear diseased. The Spleen was hard, and took up a large portion of the cavity; the structure I did not disturb as I forwarded it to you for examination. The mucous membrane of the intestines was extensively diseased and softened throughout its whole extent, as you will observe by the portions sent."

I now describe the drawings, as represented in Plate 8, E. Abundant white corpuscles in the splenic vein; the blood of the artery not examined. Five glands, varying in size from a tare to that of a pea, seated along the sulcus of the Spleen, and the lymphatic vessels proceeding from them very distinctly seen. (See Plate 1, fig. 21 of this Treatise). The lining membrane of the duodenum ulcerated and covered with dark grumous fluid, which contained numerous white blood corpuscles. The Spleen pulp contained numerous colourless crystals, with well defined edges, and often split transversely. Insoluble in water, alcohol, and alkalies. Soluble in acetic acid, and very soluble in dilute nitric acid. They are seen in Plate

1, fig. 31 A. (Blood of the splenic vein.) Dr. Holland, of Cork, to whom I sent a small portion of this Spleen, (and whose words nearly I use), made also a microscopical examination.

¶ This case is one of great interest, the enlarged spleen and liver, enormous appetite, hæmorrhagic tendency, increased size of absorbent glands, and the presence of crystals, are features of especial importance. I have seen these crystals in four Spleens, all of them hypertrophied.—*After note.*

CASE VI.—*White Bodies in the Spleen.*

In Plate 22 E, are represented the Spleen, stomach, pancreas, and gall-bladder of a man, æt. 62, whom I saw several times, in consultation with Mr. Southwood, House Surgeon to the Metropolitan Dispensary, July, 1852. He was a carpenter, and had been confined to his bed for ten months with *violent* and *excruciating* pain in the region of the gall-bladder and epigastrium. He died worn out by pain and exhaustion. He was much emaciated; the skin yellowish, but never jaundiced. A few months before confinement to his bed he was in tolerable health. I examined the body 10 hours p. m., with Mr. Prentice. Heart flabby and small; blood-corpuscles *very* small; lungs sound; pleuræ of both adherent generally from old inflammation; substance of liver normal, but its peritoneal covering was thickened, and that of the right lobe preternaturally adherent to the parietal peritoneum; the kidneys small, but sound; the pancreas, when first examined, was very hard and scirrhus-like, but the next day it was lax and soft; it weighed 1 oz. 220 grs. The gall-bladder was immensely enlarged, and contained 4 ozs. (by measure) of thick yellow bile, which, on mixture with water, exhibited a more saponaceous appearance than usual. The black cinder-like calculus represented above was at the neck of the gall-bladder. The ducts (pancreatic, hepatic, cystic, and common), were pervious. The branches of the par vaga on the smaller curvature of the stomach unusually large; those of the hepatic plexus normal. In the gastro-splenic ligament was seated a hard yellowish oblong tumor, weighing 280 grains, and containing white corpuscles, fat globules, free nuclei, granules, and long caudate cells, without nuclei. The mucous membrane of the duodenum was studded with black pigment cells, many of them of a stellate form. The splenic absorbent glands, (Plate 1, fig. 37), were of a black colour.

Spleen.—The capsule much thickened, apparently from old inflammation; it weighed 2 ozs. 380 grs. The capsule readily peeled off, leaving a bright red pulpy substance below; the white bodies are represented in the drawings, (for which also see Artery, Vein, and Absorbent Glands, E., also Plate 1, fig. 36 and 37 of this Treatise.) They were about the usual

size of Malpighian bodies, of a white colour, and of a mulberry-like shape when magnified; they were seated between the trabeculæ, but not adherent to them; the spleen pulp contained white, round corpuscles, free nuclei, and granular matter

¶ Although I spent a great deal of time in the examination of these bodies, I was unable to determine satisfactorily their nature; they were probably diseased Malpighian corpuscles, and hereafter, when better understood, may serve to throw some light on the physiology of the Spleen. In the next case the same kind of bodies were observed.—*After note.*

CASE VII.—*White Blood; Sudden Death; Liver enormously enlarged; weight of Spleen about* 6 *ozs.; Malpighian Corpuscles white.*

Outlines of Case. (Plate 25, fig. 42 *Bimana* E.) Supplied by my friend, Mr. Ebsworth, of Trinity Square. The brain and stomach sent with the Spleen, the first normal; the mucous glands of the stomach very distinct.

"The patient, M. A. B., æt. 18, found dead in bed. Previous history, unknown; but I hear she had swollen legs and dyspnœa before she retired to her last sleep.

Brain, healthy; ventricles free from fluid; *several* pints of fluid in *both pleuræ*; a pint and a half in the pericardium; heart enlarged and flabby; lungs engorged and compressed to half their *natural* volume; liver enormously large, but apparently healthy as to consistence and colour; kidneys not examined; no fluid in the abdomen; anarsarca to a slight degree in the extremities; intestines healthy, but slightly vascular in one part of the small intestines; uterus healthy; ova full of cysts, *no* impregnation." Mr. Ebsworth adds, "Cause of death resulted in my opinion from the excessive quantity of fluid in the pericardium; from the position of the bed, she had jumped on to it, and died after performing an evacuation; she lay with her head the reverse way to the proper position; no valvular disease of the heart. I have little doubt that the patient had been ill for a long time, though she continued working to the last."

¶ A slice of the Spleen of this patient is represented in Plate 1, fig. 29 of this Treatise. The blood corpuscles, as seen in Plate 25 E, were large, and nearly all colourless, both in the splenic artery and vein. One of the lymphatic glands, near the Spleen, also shown in this plate, was about the size of a large pea, and the lymphatic vessels were very distinct. The spleen-pulp, and the contents of the white Malpighian corpuscles, consisted chiefly of irregular-formed vesicles, with some red pigmentary matter. A few of the vesicles from the white corpuscles appeared to be granular. The case is a good example of an ordinary sized Spleen with a very large liver, and in this instance, it is questionable whether the white blood was occasioned by the abnormal state of the Spleen?—*After note.*

CASE VIII.—*Fatty Tumor of the Spleen with fatty Liver.*

Mrs. —, æt. 26, had been for some time before her death affected

with lumbar abscess, attended with profuse purulent discharge, and much emaciation of body. Upon the sulcus of the Spleen near the centre, was a long, rounded, whitish tumor, about the thickness of the finger, which, on microscopical examination, presented a fatty appearance; the blood of the artery and vein contained numerous oil globules, and a few were seen in the Spleen substance, but this scarcely left a trace of grease on blotting paper. The Spleen weighed 4 ozs. 230 grs. The weight of the body was about 6 stone. The liver weighed 5 lbs. 6 ozs. It was of a whitish yellow colour, and contained an immense quautity of oil, like the liver of a cod. On boiling 10 grains of it in æther for three or four minutes it was reduced to 2 grains. The same quantity added to *Liq. Potassæ*, was reduced to 6 grs. The other organs were not carefully examined. (Plate 17 E, and Plate 1 of this Treatise, fig. 27).

¶ This case is another good example of an enormous sized liver, with a small Spleen. Many white corpuscles were present both in the blood of the artery and of the vein.—*After note.*

CASE IX.—*Spontaneous Rupture of the Spleen.*

The following Case occurred in the practice of my friend, Mr. B. Evans, of Brixton, who has supplied me with the subjoined outline :—

"Miss S., aged 22, of fair complexion, and inclined to *embonpoint*, had generally enjoyed very good health, resided in Essex, in a district removed from the marshes, and usually healthy, but at this time, much visited by ague, was attacked with tertian ague, twelve months ago, had taken arsenic and sulphate of quinine, which had subdued the disease, and at this period was taking, as a prophylactic and tonic, quinine three times a day. The general health suffered less than usual under the disease; her appetite was good, and she never entirely lost her florid and healthy colour, but had complaiued of fuluess of the stomach and occasional faintness, which, on examination, led to the belief that she had 'ague cake,'—enlarged Spleen.

"In 1828, she had just partaken of a hearty dinner of roast meat, &c., when she complained of great faintness, with acute pain in the left side and region of the stomach. The countenance was blanched, and she threw her arms about from side to side (a symptom so peculiar to internal hemorrhage); in this state I first saw her; the pulse was lost at the wrist; extremities cold, accompanied with deep sighing. Brandy was giveu, warmth applied to the feet, and a mustard plaster to the epigastrium. She said she was better, and rallied so far, that the pulse could be felt at the wrist, and she breathed with less difficulty. She, however, sunk rapidly, and died in about an hour from the commencement of the attack.

"*Sectio Cadaveris.*—40 hours after death. A considerable quantity of fluid blood was found in the cavity of the abdomen, and a large coagulum beneath the left extremity of the stomach, which was carefully and plainly traced by its adhesion to the Spleen to have proceeded from a fissure on the outer surface of that organ, an inch and a half in length, and three-fourths of an inch in depth. The Spleen itself was full five times its usual size, of placenta-like feel, and of a dark red colour; the trunk of the splenic artery and the veins enormously enlarged. The other viscera of the body were found healthy, but of a pale colour. The head was not examined."

¶ The occurrence of this rupture, after a full meal, is a circumstance that bears especially upon the physiology of the Spleen.—*After note.*

PATHOLOGY OF THE SPLEEN OF THE LOWER ANIMALS, AS ILLUSTRATING ITS PHYSIOLOGY.

The examinations, drawings, and preparations of the diseases of the lower animals also, I think, afford matter for contemplation and further research.

In the bird with its lungs mouldy before death, the liver may be full of tubercles and the Spleen perfectly free from disease. On the other hand, the Spleen may be full of tubercles and the liver perfectly healthy; or the lungs may be studded with tubercles, and one or both of these viscera sound. But the question of most interest bearing on the physiology of the Spleen, is the cause of the greater frequency of tubercle of this organ in birds and some of the lower animals than in man. It will be an interesting enquiry hereafter, whether a part of the systemic blood (in birds) passing through the portal-vein will account in any way for this?

In the Veterinary College is the model of the Spleen of a horse, which weighed 76 lbs., but the animal did his work well; the animal, a riding-horse, carrying his master up to the age of 17 years, when he was killed.

The table of the examination of the Spleens of horses affords several examples of those animals being apparently in perfect health when the Spleen weighed 8 or 10 lbs. The ruptured Spleen, too, of one of these animals, from violence, and its subsequent repair of the rent, (Prep. 160), is a fact of great pathological interest.

Time compels me to finish this Essay, scarcely two pages of which I have been able to peruse after it has been copied, and I am compelled to leave the pathological illustration of the uses of the Spleen in this imperfect state.

Before I terminate this section, I may fairly allude to the specimens of the Bile, and to the fifteen plates of the morbid conditions of the Spleen of the lower animals, as they form a part of the original Essay. The Bile comprises 18 specimens from the human subject, and 115 from the lower animals. Both in man and quadrupeds it differs much in color and consistence, the former presenting every variety of shade—from a light to a dark yellow, and from a light green to a very dark green. The consistence also

varies from that of water to treacle, and in the thick Bile, granules and much cholesterine are present. My object, as before stated, in collecting the Bile, was to endeavor to test the correctness of Kölliker's opinion, "that the decomposed blood-globules in the Spleen form its coloring matter." An opinion, I think, shewn to be false by the above evidence, and more especially by that adduced in the chapter on Extirpation of the Spleen.

The plates on the pathology above spoken of are No. 1. Tuberculated Spleen of a Chacma Baboon, of a Green Monkey, and of an Agouti.—2. The Spleen, stomach, kidney, and right lung of a Patas Monkey, the left lung one mass of Fungus Hæmatodes, the other lung sound, as were also the Spleen and liver.—3. The Spleen of a *Harte Beeste* shewing false aneurism.—4. The Spleen and liver of the Taira, enlarged and tuberculated, the mesenteric glands greatly enlarged, the other viscera (also represented) healthy.—5. The Spleen and liver of a *Coati Mondi*, the former thickly studded with tubercles, the latter organ free from them; as were also the lungs, a portion of which is represented with a mesenteric gland, much enlarged.—6. The Malpighian corpuscles of a horse magnified, shewing the veins emerging from them;—a fissure in a horse's Spleen, united by cellular bands;—the Spleen pulp, with a portion of the ulcerated liver of a glandered horse. The Spleen pulp contained black pigment, nucleated cells, vesicles, and large cells, with red coloring matter, probably hæmatin. The black pigmentary matter, (melanotic) from the root of the tail of a grey horse, magnified, 500 diameters. Horses of this color are especially liable to this deposit. The Spleen of a Horse, ruptured some years before, the rent (cicatrized,) three inches in length. The thirteenth rib over the Spleen had been fractured.—7. Tuberculated Spleen and liver of a Stanley Crane, with the mouldy lung and the sporules magnified. 8. Tuberculated Spleens and livers of two Eagles, the tubercles many of them nearly as hard as peas, presenting, on section, concentric layers of irregular thickness.—9. Tuberculated Spleen of a Maccaw. Hypertrophied Spleen of a Pea-fowl, the Spleen weighing 4 ozs. Tuberculated Spleen of a Crane, the tubercles hard, and many of them projecting from the surface. Tuberculated Spleen of an African Guinea-fowl.—10. Tuberculated Spleen, with the alimentary canal and the other viscera of a Mandarin Duck.—11. The tuberculated Spleen and liver of the common Crane, (Table No. 10, p. 106). A section of the tubercle shews the deposit to be in concentric layers, the tubercles in the Spleen, as shewn by the sketch, were many of them mulberry-shaped. The blood presented a very remarkable appearance (fig. 1).—12. The Spleen, liver, and kidneys of a Guan injected (see Plate 3). The two first named organs studded

with tubercles. Tuberculated Spleen and liver of another Guan, with a fibro-cartilaginous tumor in the abdomen, weighing 476 grs.—13. Tuberculated Spleens of a Hybrid Pheasant, Mandarin Duck, and Gannet. Tuberculated Spleen and liver of a common Pheasant (the bird in confinement). Enlarged and tuberculated Spleens and livers of two Hens, the birds had been kept in a confined place.—14. Hypertrophied Spleen of an African Partridge, containing small granular tubercles. (Fig. 2.) Appendices ulcerated, the liver also tuberculous; the Spleen, liver, duodenum, pancreas, and gall-bladder of a Stanley Crane; the three first named tuberculous.—15. The gizzard, Spleen, kidneys, and other parts of a Stone Curassow; the stellate tubercles on the Spleen and kidney were covered with mould, the sporules magnified 500 diameters.—16. The Spleen, liver, and duodenum of a Native Companion Crane tuberculated. The Spleen injected with size and vermillion; the tubercles (as seen in the sketch) are surrounded by vessels, but none of these that I could discover passed into them.

¶ The tubercular matter in this and other specimens appeared to me to be deposited originally around or upon the Malpighian bodies. *After note.*

¶ The above coloured drawings, like all in the Essay, were taken by measurement. The gall-bladder painted with the bile was represented to shew the colour and consistence of that fluid, and the size of the reservoir which contained it.

I may remind the reader as an additional motive for the introduction of the above description of the Plates copied from the Essay, that the pathology of the lower animals, more especially of birds, reptiles, and fishes, has been but little attended to, either in this or in other countries, and I believe hereafter that much light will be thrown upon human physiology and pathology by the careful investigation of the diseases of the lower animals.

PATHOLOGY OF THE HUMAN SPLEEN, AS ILLUSTRATING ITS PHYSIOLOGY— *(resumed from page 160.)*

¶ It was my intention to have made a table of the most important cases of diseased Spleen on record, a system I have pursued in my *Jacksonian* Essays on the Blood Vessels, and on Intestinal Obstructions, but my remarks have already extended farther than I anticipated, and I will therefore speak only of a few matters which would have occupied the concluding pages of the Essay, had time permitted. And first of the blood. In Plate E, I have figured the blood-corpuscles of nine patients that I attended at the *Metropolitan Dispensary*. No. 1. The blood of a healthy man. Three white corpuscles were seen in the field of the microscope.—2. Blood of a man, æt. 45, with enlarged Spleen. All the isolated corpuscles are large and white.—3. Blood of a girl, æt. 13, whom I ordered to be bled fourteen days before for *Pericarditis*. The blood-corpuscles, many of them large and white; the patient convalescent, but blanched and anæmic.—4. Blood of an infant, æt. 4 months. No white corpuscles.—5. Blood of a chlorotic girl, æt. 18, who had taken iron for several weeks. Many whitish corpuscles, and some free nuclei, round, and about one-tenth the size of the blood-corpuscles.—6. Female, æt. 17. *Chlorosis* for six months; many whitish corpuscles, but

not so large as in the last patient.—7. Boy, æt. 10. Tubercles in both lungs; last stage. The blood-corpuscles with dark centres, and many of them linear.—8. Blood and pus-corpuscles from an abscess in a child's neck, to shew the resemblance of the latter to the white corpuscles.—9. Pus-globules from the neck of a healthy child. The globules larger than the last named, and about double the size of ordinary blood-corpuscles.

Ague.—I have had only one opportunity of examining the blood of an aguish patient, a man 40 years of age, who had had quotidian ague for a long time, and whose Spleen was much enlarged. The blood-corpuscles were of a stellate form, and some of the small nuclei described above, in Case 5, were present, but not a single white corpuscle. In a case shewn at the Pathological Society, by Dr. Quain, they were very abundant.

The most remarkable and interesting example, however, has lately come under my care. A lady whom I saw several times, with enlarged Spleen, and whose blood I examined at the bed-side, under the microscope. She was seen by several physicians of eminence, and the liver was not supposed to have been diseased. I opened the body, which was much emaciated, and found the liver large and white; the right lobe extended down to the pubes. The liver weighed 5 lbs. 10 ozs. The Spleen, dense and solid, weighed 4 lbs. 4 ozs.; and a small supplementary Spleen, the size of a walnut, was attached to it. The blood in this case, both during life and after death, consisted chiefly of large white corpuscles, somewhat like pus-globules, but many of them double the size. The case is another example in support of one of my conclusions, viz., that *Leucocythemia* depends as much upon the condition of the liver as of the Spleen; but the subject, as Dr. Bennett has admitted, requires much careful investigation.

Dr. T. S. Holland, in the *Microscopic Journal*, 1853, p. 176, relates a case of *Goître* in a man 76 years of age, "in which the colourless corpuscles of the blood (after death) were seven or eight times more frequent than usual. The Spleen was free from disease. In another instance, the thyroid gland was enlarged to four or five times its natural size, the Spleen being normal; the blood of the abdominal aorta was in a normal state, whilst that of the pulmonary artery contained a great excess of white corpuscles." Dr. Holland very properly urges a more extended examination of the blood in all such cases.

Softening.—For softening of the Spleen and other affections of this nature, the works of Dr. Davis on the *Walcheren* fever, 1810; *Vetch Medical and Physical Journal*, 1824; and the Treatises of Bertrand, Couzier, Larrey, Bugnet, and Clot Bey on the Plague, will afford the best information.

Clot Bey in his admirable account of the Plague in Egypt, 1840, *(De la Peste observée en Egypte,)* says, "The Spleen was almost always double its natural size, and sometimes more; rarely petechiæ and spots. Its parenchyma was gorged with blood, softened often to the condition of pap, always high coloured. In some cases the organ appeared to be normal. The liver was always gorged with blood. The consistence of the Pancreas generally increased; in three cases it was double its natural volume.'"

Obstruction in the Vein.—Enlargement of the Spleen may sometimes take place from obstruction in the vein preventing the return of blood from the organ. "M. Barth recently showed a Spleen at the *Academy of Medicine in Paris* of an enormous size. The patient had never had intermittent fever. The cause of this immense increase was a clot which entirely obliterated the splenic vein." *(Revue Med.*, 1855, page 43.*)*

Fevers.—Andral in his *Clinique Medical* records the autopsies of 33 cases of continued fevers. Of these I find on examining the cases, that in eight this organ was large and soft—in two large—not much enlarged in one—small and dense in one—one natural; and in the remainder the appearance

of the Spleen is not mentioned. In 25 cases of disease of the liver and its ducts, related by Andral, the condition of the Spleen is not spoken of.

Mr. Twining, in the 3rd vol. of the Transactions of the *Medical and Physiological Society* of Calcutta, 1827, says, "In chronic engorgement of the Spleen, very frequent in Bengal, mercury in every form was found to be peculiarly injurious, a very few doses producing great debility, profuse salivation, and sloughing of the gums and cheeks, which in many cases proved fatal." A preparation of Sulphate of Iron and Bitartrate of Potash was found to be the most efficacious medicine The chief symptoms besides the enlargement of the side, were extreme debility, paleness of face, dry and soft skin, and a leaden appearance of the conjunctiva. The Spleen, when examined after death, "broke down in the hands and became a putrid gore."

Pain in the side.—The frequent occurrence in females of pain, and the sensation of a heavy weight over the Spleen, is probably due to distension of this organ with blood, and the aching of the side often experienced in childhood, after running a quick pace, may, I suspect, arise from the same cause. Dr. Bree, who published a paper in the "*Philosophical Transactions*," vol. 2, "on painful affections of the side from tumid Spleen," found this pain relieved by hæmorrhoids and the menstrual flux.

Hæmorrhage.—The tendency to hæmorrhage in enlargements of the Spleen is very great, as shewn in the cases already related. My brother, Dr. Henry Crisp, Surgeon to the 63rd Regiment, was some years in Scinde, and he writes me, "that in this country, where continued, remittent and intermittent fevers are very prevalent, enlargement of the Spleen is frequently met with; the organ sometimes reaching to the pubes, the countenance bloated and of a leaden hue; pain in the shoulder and side, and hæmorrhage from the mucous membranes being some of the chief symptoms."

Mr. Thomas, (*Lancet*, 1830, p. 585,) mentions a fatal case of hæmorrhage from leech bites, in a child 5 years of age; the Spleen weighed 3 lbs., and was of a firm texture, like liver. A similar case is related by Dr. Bon, (*Lancet*, 1836.) It will be interesting hereafter to inquire minutely into the condition of the Spleen in those curious cases of hæmorrhagic diathesis prevailing in certain families? In Mr. Wardrop's lectures, published in the *Lancet* for 1833—34, vol. 1, p. 132; he says, "I attended a patient, where the introduction of a common seton-needle in the side was followed by a fatal hæmorrhage. A gentleman, who had an enlarged spleen, was advised to have a seton introduced in his side, and this was done, in the usual manner, by Sir Astley Cooper. Alarmed by the quantity of blood oozing from the wound, I was sent for to see the patient in the evening of the same day. On withdrawing the cord, pressure, carefully applied, with graduated compresses, did not avail, and the hæmorrhage being so profuse, as to make it appear probable that some vessel of considerable size had been wounded, I thought it expedient to divide that portion of integument which existed between the two perforations of the seton-needle. Having done this, I found that the blood issued from numerous orifices, and I secured no less than nine vessels with ligatures. Blood continued, however, to ooze from numberless small orifices over the whole surface of the wound, which every mode of treatment usually employed failed in arresting, and the patient died in a few days."

Rupture.—In addition to the case of spontaneous rupture of the Spleen, related at page 159, others have been recorded. In the "*Archives Générales de Médecine*," 1854, p. 85, a case of spontaneous rupture of the spleen is related, in a soldier who had had intermittent fever for 6 months. "He died a short time after the first accession of pain; the Spleen (enlarged) was ruptured in three places; the liver was hard, large, and yellow."

Rupture of tho Spleen has not unfrequently occurred from violence, and always, as far as I know of, proved fatal in the human subject; although, judging from the case of the horse before alluded to, death does not always take place in the lower animals. Four cases of rupture of the human Spleen, from violence, are recorded in *Haller's Disputationes ad morborum historiam et curationem*, vol. 4, p. 5, by Scheid.

Acute Splenitis, terminating in abscess, is less frequent in this country than in the East, but several cases are recorded in the European journals; the abscess may burst into the chest, alimentary canal, or peritoneal cavity. Gangrene also may result as in other organs, from acute inflammation, but this lesion I believe is rare.

Malignant disease of the Spleen is but seldom met with, and it is questionable whether true cancer ever occurs in the Spleen? The absence of malignant tubercle in the spleen, before-mentioned, when it is abundant in the liver, is a fact of physiological importance. A few months since I exhibited the Spleen of a man at the Pathological Society, who had *Fungus Hæmatodes* of the spleen, liver, heart, pelvic and other bones. The deposit in the spleen and liver was in large brainular nodules, and the blood contained numerous round sporule-like bodies about ⅛th the size of blood corpuscles; these were very abundant in the soft parts of the tumor, and might perhaps not improperly be called the seeds of the disease. (*Medical Times and Gazette, February* 17, 1855.)

Hydatids are but rarely found in the human Spleen, but among the ruminating animals, as the tables shew, they are not of unfrequent occurrence.

Bony and *cartilaginous* deposit is not uncommon on the capsule of tho Spleen of old persons. I have never seen this in the lower animals, but in a *Leucoryx* I found bony tumors in the Spleen, and a large amount of bony and cretaceous deposit in the lungs.

The splenic artery is but rarely ossified, the case mentioned by Dr. Bristowe, page 150, is an example.

Registrar General's Reports for the Metropolis.—It is probable that disease of the Spleen *alone* seldom or never proves fatal, but in the Reports above named, I find under the head of deaths from disease of Spleen, from the year 1840 to 1853, the following in these fourteen years: 4, 2, 9, 7, 4, 9, 16, 3, 12, 11, 12, 13, 16, 12, 12.

Extirpation of the Human Spleen.—I scarcely need allude to the fact, that tho human Spleen has been removed (in consequence of a wound), and that the individual has lived for many years; this organ too has occasionally been absent at birth. In *Muller's Archives*, 1842, p. 57, the case of an infant is related "that lived three days; it did not take the breast, and was in a somnolent state up to the time of its death. The left upper extremity was only rudimentary; in place of the stomach was a small sac, 13 lines in length. The liver was very large, and the Spleen entirely wanting."

The size of the Spleen at different periods is a matter of some interest as regards this enquiry. In the *Recueil de Memoires de Médicine, de Chir. et de Pharmacie Militaires*, by Jacob and Marchal, vol. 1, 1850, it is said—"M. Durand having examined 1,545 cases of intermittent fever at the Military Hospital of Tenez, in 1845-46 and 47, and made out their size accurately by percussion, came to the following conclusions:—1st. That during the entire year the Spleen is generally more voluminous in the morning than in the evening, in the proportion of 0.793, or about three-quarters. 2nd. That in the winter six months the proportion is 0.769 to 0.817 in the summer six months. 3rd. That in January (the month of least engorgement) the proportion is 0.626 to 0.858 in August, this being the month of greatest engorgement."

I quote the above, although I have much doubt as to the possibility of arriving at an accurate opinion upon the subject.

The recent discovery of cellulose in the Spleen, is a circumstance that should not pass unnoticed; but, as Meckel has observed, the presence of cholesterine may have led to error. In the diseased Spleens of some of the lower animals, this substance (cholesterine) is very abundant. I have not had an opportunity of employing the tests for cellulose, but I believe that the same result will be found, as in the experiments detailed on the human Spleen by Virchou, Christensen, Huxley, and others.

In this interesting enquiry it is difficult to adhere strictly to the physiological question. The subject at present is confused and obscure, but greater attention to the morbid conditions of the Spleen, will hereafter lead, I believe, to important physiological results; and I think that science is much indebted to Dr. H. Bennett for his labors in this field of investigation, although I differ from him in some of his inferences.

Looking then to the above imperfect evidence of the pathology of the human Spleen, it serves, I think, beyond a doubt, to confirm the correctness of one of my conclusions, viz., that the Spleen is a *reservoir* for the blood. As regards the other, the *secretory* function, but little light has been at present thrown upon it by morbid anatomy; this is reserved for future enquirers. The question however of most importance is the one discussed in the next chapter.

PATHOLOGY OF THE LOWER ANIMALS, AS ILLUSTRATING THE PHYSIOLOGY OF THE SPLEEN—*(resumed from page 163.)*

¶ Those who have examined the tables, and the cause of death of the various animals inspected, must have been surprised at the great variety of morbid lesions there exhibited. The prevalence of tubercle in the Spleen of many animals, especially in birds, is a matter of peculiar interest.

In looking through the tables it will be seen, that in the quadrupeds tuberculous deposit was most prevalent among the *Quadrumana* and *Carnaria*, occasionally in the *Marsupiata*, but never present in the Kangaroos (animals with valves in the splenic vein), although the liver of the Tree Kangaroo was tuberculous. In the Ruminants and Pachyderms, animals likewise with valves in the splenic vein, I never found tubercle in the Spleen. In the Rodents, in the beaver only, (excepting wild mice and rats, to be afterwards mentioned). In the *Edentata* and *Cetacea*, the specimens were too few to judge of. In the birds, as will be seen, tubercle is more prevalent than in any of the other classes, more especially in the rapacious, gallinaceous, wading, and water-birds.

The subjoined account of the morbid anatomy of the rapacious birds *(Accipitres)* will suffice for all.

In the Harpy Eagle, No. 4, the Spleen was tuberculated; the liver large, but apparently sound; and in No. 8, both Spleen and liver were enlarged. In an Eagle Owl *(B. Orientalis)* I have since dissected, the liver was studded with small greasy tubercles, and the Spleen, which weighed 75 grs., was converted into a uniform fatty mass, presenting under the microscope fat globules and granular matter (Prep. 299). The bird weighed 2 lbs. 2 ozs., and was not in very bad condition. The lungs were sound. In a Chilian Sea Eagle *(F. Aguia)*, weighing 6½ lbs., and very fat, the Spleen was a mass of tubercle; it weighed 91 grs. (Prep. 300). The liver, which weighed 300 grs., contained a few small tubercles. This bird had been 17 years in the Regent's Park Gardens. In a Whistling Hawk *(———? Australia)*, the Spleen weighed 248 grs. It was a mulberry-like mass of tubercle, without a trace of normal structure. The liver was of a whitish colour, but not

tuberculated; it weighed 581 grains. (Prep. 301). In a Peregrine Falcon, weighing 23 ozs., which had been a long time in confinement, the Spleen, liver, and pericardium were covered with tubercles, and *filariæ* were embedded in the cellular tissue at the root of the great vessels of the heart. Lymph on the peritoneum, under the microscope, showed mould-sporules (Prep. 302).—(*Trans. Path. Society of London*, 1854, p. 345.)

In reptiles and fish, I have never found tubercle in this organ. The inference of most practical import concerning the Spleen is, that it may be extensively diseased and yet the animal may appear to be in good health and condition; and that the Spleen may be full of tubercles, the liver sound, and *vice versâ*.

My time will not allow me to allude here to the condition of the blood in many of these animals; indeed the morbid anatomy, if properly described, would occupy a far greater space than these pages have already extended to. Among some curious lesions of the Spleen, I may besides mention false aneurism, bony deposit, and *cysticerci* in the Harte Beeste, Leucoryx and Alligator.

In wild animals, I have seen hypertrophy of the Spleen in the hare and rat; and in a wood-pigeon that I shot, the Spleen was about the size and shape of a mulberry; it weighed 30 grains, and was of a whitish colour. The nodules on its surface were, I believe, diseased Malpighian bodies. The Spleen contained numerous white round corpuscles, besides shrivelled blood globules and granular matter; none of the white corpuscles or vesicles were present in the aortic blood. I have never seen the Spleen of this form in a bird in confinement.

Last winter I examined several wild mice and sparrows that were found dead at the Regent's Park Gardens. In some, the liver and Spleen were enlarged and inflamed, and in others, both these organs were tuberculated; the inflammatory condition, I believe, preceding the deposit of tubercle. The alimentary canal presented no appearance of poison having been taken, nor is it probable that any poison would produce such effects; food and locality were the more likely causes.

I now, in conclusion, allude to a condition of the Spleen in the lower animals, which requires further investigation.

During the period that I was attending especially to the pathology of this organ, I made enquiries of extensive agriculturalists, and those engaged in the management of cattle, as to the state of this viscus in epidemic diseases, and other affections in sheep and oxen? I received some strange communications upon this subject, to which at the time I attached but little importance, but subsequent research has led me to regard them with much interest. I subjoin two or three of these. Mr. J. Williams living on the eastern coast of Suffolk, lost 40 oxen in one year, (from October to June,) which were turned into a marsh near the sea. The spleens of all that died were black and bloody, and many of them weighed 20 lbs. Eight sows that ate the spleens died within twenty-four hours, and many pigs were killed in the same manner. Four of five colts in the same marsh also died very suddenly, drinking large quantities of water for several minutes before death. I naturally looked upon this statement with some suspicion, and I wrote to Mr. Steel the Veterinary Surgeon, who I ascertained had attended these animals, and he kindly sent me the undermentioned reply:—

"*Bucklesham, December* 13, 1852.

"Dear Sir,—In answer to your request, as stated in yours of the 9th instant, made with reference to oxen that have died at various times on the farm of Mr. J. Williams, at Trimley, I have to state, that in the year 1842, my opinion was requested by Mr. Williams, respecting a disease then raging

among his oxen; prior to my arriving at the farm, eight or nine bullocks had died, and several more were then very ill. On making enquiry as to the probable cause of their death, the farrier in attendance gave his opinion that they had all died of disease of the Spleen; this organ was described by him as being much enlarged, very black, and very tender. He likewise stated that the bowels of some of them were very black, and the lungs enlarged and much discoloured. I was requested to treat the remainder, about fifteen; three were slaughtered during treatment, in none of which were found any marks or trace of disease in the Spleen; they were all three decided cases of Pleura Pneumonia; mild cases, and possibly might have yielded to continued treatment; the remainder all perfectly recovered. Since that period to the present time there have been several visitations of a like nature upon this farm, but they have all been cases of Pleura Pneumonia;—some have yielded to treatment, and some have died; among which I have not seen a single case of diseased Spleen; nor have I ever yet, during twenty-five years' practice, seen a case of disease of that organ in any animal. About twenty head of swine died on this farm during the time of the bullocks' dying; their death was supposed to be occasioned from eating the blood and entrails of the beasts. Several ferrets died at the same time, which had likewise eaten of the flesh; but I saw none of them, therefore can offer no opinion on the subject.

"*Recorded cases of Disease of the Spleen.*—Enlarged spleen; a change perhaps attributable to a kind of chronic *Splenitis*. This organ in the Horse has been found hypertrophied, much augmented in volume and weight, and yet exhibiting no appearance of disorganization. It has likewise been found in a state of ossification. We have also cases of lesion and rupture of this organ recorded. It has been found likewise in a complete state of scirrhus in the Horse.

"I remain, Sir,

"Yours most respectfully,

Dr. Crisp. "John Steel."

About the same time, I received the following information from my brother, Mr. Thos. Crisp, of Chillesford, Suffolk. "Mr. A. lost an ox last summer (1850), (fed on marshy ground), from disease of the Spleen. This organ was two feet long, and one in width, and much ulcerated; bloody and pulpy; so that it readily 'fell to pieces.' The butcher who handled this spleen had his arm so affected that he was unable to use it for some time. Cats died from eating it; and a sow that ate the paunch and a part of the Spleen also died. In another instance, an ox was supposed to have died from diseased Spleen; the organ weighing eighteen or twenty pounds. A sow died after eating a part of the spleen; and a man who cut his finger whilst removing it from the body states 'that the wound did not heal for many weeks.'"

I have before observed, I did not attach much importance to the above statements, believing that they were exaggerated, and that false inferences had probably been drawn from results that would admit of a different interpretation. Since then, I have obtained evidence of a like nature from Mr. Cooper, of Great Oakley, Essex, and others, so that I have now no doubt as to the correctness of this information. On looking over the "*Memoirs de la Société de Biologie,*" Paris, I find, according to M. Rayer (vol. 1851, p. 141), "that a large number of sheep in certain districts in France have died of a disease called '*Sang de Rate.*' Sheep inoculated with the splenic blood died in less than four days; *petechiæ* and *ecchymosis* of the lungs being present, as in the '*Sang de Rate.*'"

M. Barthelemy performed similar experiments in 1823. The first sheep died in 60 hours; another, inoculated from this, died in 36 hours; others, from 36 to 48 hours. A horse in 88 hours; and a sheep inoculated from this horse in 53 hours. The disease produced great ravages among the sheep in certain districts in France.

There are some facts, however, yet to be determined, viz., is this poisonous matter more virulent in the Spleen, or is it confined to this viscus, or does it pervade other organs? The question is one of great interest and importance; and it may turn out hereafter, that in some low forms of fever, and in some malignant epidemics, that a poison of a peculiar kind is generated in the Spleen. I have already quoted the opinion of M. Aubert page 151, (concerning the *Typhus Icterodes*, which proved fatal to 2,000 of the population of Moscow in thirteen months), "*that the putrid and purulent Spleen was the cause of the fever.*"

CONCLUSIONS.

Seeing that the spleen can be removed with impunity in some animals, and after its removal all the functions of the body may be (as far as we can judge) as well performed as before, it is fair to conclude that it is an organ comparatively of little importance in the animal economy.

That the assertion of *Blumenbach*, *Monro*, and other anatomists, that the spleen decreases in size from man to the fish, is founded in error; for the spleen of many fishes, so far from being smaller, is larger than in any other animal.

That the statement by most writers, respecting the comparative size of the spleen and pancreas in birds, does not apply to all the genera.

That judging from the use of the microscope, the application of galvanism, and physical elasticity, no part of the spleen possesses any muscular fibres.

That taking into account the large amount of elastic tissue in the spleen; its capability of distension; its resumption of its former size; the valvular arrangement of the mouth of the veins, and its network of trabecular tissue, which is so placed as to assist, under certain circumstances, the circulation of the blood, I infer (as many have done before me) that one of its offices is that of a reservoir or receptacle of the blood, *not required by the liver;* and that its state of distension or repletion depends much upon the condition of that organ.

That in what is called white blood, or *Leucocythemia*, it is probable that the liver has more to do with the alteration in the blood than the spleen; an inference, strengthened by the two cases related in the Appendix, and by the fact, that in numerous instances of *Leucocythemia*, the spleen has been found in a normal condition.

That as in all quadrupeds (speaking from my own dissections) the spleen is on the left side of the stomach, and in many attached to the diaphragm, it is more than probable that this muscle, when the stomach is distended, produces considerable influence on the circulation of the blood through the spleen.

That in birds, reptiles, and fishes, nearly all of which are unprovided with a muscular diaphragm, the spleen is for the most part seated on the right side of the spinal column.

That after careful and extensive examinations of the spleen-pulp of different animals, I have failed to detect the blood-cells and decomposing blood-cells described by Kölliker.

That the assumption that the coloring matter of the bile, is formed by the decomposed blood corpuscles has no accurate foundation.

That in animals, the spleens of which have been excised, the bile presents no important alteration, either in its appearance or in its normal composition.

That the arteries terminate abruptly in the spleen, in tufts, which surround the *Malpighian* body, and serve for the secretion of its contents.

That the blood of the splenic vein is coagulable, and that it differs in no important particular from the blood of the artery.

That from numerous experiments upon rats, mice, and birds, I am unable to discover that quinine, the poison of reptiles, and other noxious agents, produce any immediate contraction or special influence upon the spleen.

That judging from the table of cases of *Phthisis*, in which the weight of the spleen did not exceed six ounces, and the size of the liver was much increased, it is fair to infer that the office of the spleen cannot be, as supposed by *Dollinger*, and others, that of a supplementary liver.

That judging from the examination of a great number of the bodies of the lower animals (kept in confinement) in which the spleen was enlarged and tuberculated (see preparations and drawings), the liver being sometimes tuberculous, and at other times normal, and *vice versâ*, it is probable that the connection between the spleen and the liver (excepting the mechanical one) is not so intimate as has been hitherto supposed.

That when the stomach is full, the splenic artery is probably straightened, and in this manner, the flow of blood to the stomach is facilitated.

That with the exception of the *Cheiroptera*, the spleens of which resemble the rodents, the spleen of an animal examined, will alone tell the class to which it belongs.

That the spleen of the *Quadrumana* bears the greatest resemblance to that of man, and that the lower we descend in the scale

of creation, (with a few exceptions), the greater is the dissimilitude of the spleen to that of the *Bimana*.

That the weight of the animal does not indicate the size of the spleen, as the deductions from the Table of the examinations of one hundred and twelve horses prove.

That in fat animals, judging from the examinations of prize sheep, pigs, and oxen, the spleen is smaller than in those in tolerable condition.

Finally.—That taking all circumstances into account, with the evidence that I have obtained from the dissection of Man and the lower animals, bearing in mind especially the relative proportions of the viscera in the various classes of animals that I have examined; and looking *particularly* to the effects of extirpation of the Spleen, as exhibited upon the bodies of the three animals, a dog, cat, and rat, sent in jars, accompanied by animals (with spleens), fed and treated in the same manner, I infer, as before stated, that the spleen is comparatively an unimportant organ in the animal economy.

That one of its offices is that of affording an adequate supply of blood to the stomach and liver, and to act as a reservoir for the blood, when the balance of the general circulation is deranged.

That another of its offices, is, judging from the beautiful arrangement of the Malpighian corpuscles, and the distribution of the arteries upon them, and especially by the action of heat and nitric acid upon these corpuscles, (never, I believe, before noticed), to secrete an albuminous fluid, which performs some part in the process of sanguification.

N.B. I have no time to place these conclusions in their proper order.

¶ I now ask myself, what alterations or additions I shall make to these conclusions, written in December, 1852, and after working at the subject almost without intermission since that period? We are all generally loath to change our opinions; but, as far as my subsequent experience has gone, I believe the conclusions then arrived at, to be substantially correct. Those respecting the size of the Spleen in fishes require some modification, but the inferences are, I believe, in the main, right. The remark respecting the pancreas is only meant to apply to some birds; in the chicken, the Spleen is often heavier than the pancreas. The connexion between the stomach and the Spleen I have explained at page 138; that of the liver is so fully proved as to require

no comment. The mistake I probably made respecting the Spleen of some of the *Ophidians* is explained at page 119. The most faulty perhaps of the conclusions is that respecting the microscopic appearance of the blood of the splenic vein in some animals. My investigations respecting this matter were, as I have before mentioned, confined more especially to the human spleen, and this blood, and that of the lower animals was rarely in a fresh state. In my recent examinations I have often found more white corpuscles and albuminous flakes in the splenic venous blood than in the arterial; but in numerous instances no perceptible difference was observed; from three to four white corpuscles only, being under the field of the microscope in both. The narrow, linear, and irregular shaped corpuscles, are not confined to the venous blood of the Spleen, but are often present at the same time in the blood of the splenic artery. I select a few extracts from my notes respecting the appearance of the blood of the splenic vein of different animals that I have more recently examined. Beaver—Tubercles in lungs and Spleen, no white corpuscles in the venous blood, but some granular matter; three white corpuscles in the aortic blood, and less granular matter. Cat (aged 20 years), the blood corpuscles irregular in form, no white corpuscles; the same appearance in the aortic blood. Ocelot—several white corpuscles, some of them apparently broken up into irregular formed masses, also some yellow bilious matter like that often seen in the spleen of fishes. Large Mastiff—No white corpuscles, but several albuminous flakes. In the Nestor Monkey, the blood of the vein and of the artery appeared to be the same, as it was likewise in the Rabbit, Hare, and Rat. In a cat that I have just killed, the white corpuscles were about the same number as in the arterial blood, but very abundant in the spleen-pulp. In an ox that died of *Pleuro pneumonia*, the white corpuscles were very abundant in the blood generally, but there was scarcely one red corpuscle in the splenic venous blood. In all future experiments the blood of the *vena portæ*, and of many other veins, should be likewise examined.

I have to add some remarks respecting the arrangement of the blood vessels in the Spleen of the ruminants; my notions respecting them, are at present but crude and ill-defined; but I will mention some experiments I have recently made on the Spleens of the sheep and ox. I stated, page 39, that on injecting the Spleen of a sheep with 3 ozs. of water, 6 drachms returned by the vein. In Plate 10, *(Ruminantia*, E,*)* I have shewn the veins surrounding the Malpighian bodies in a star-like form. I have injected the Spleen with various fluids, and I find that these vessels, many of them very large, can readily be injected, either by the artery or vein; that if the artery is first injected with a white fluid (thin paint, *e. g.*) and the vein with a red-coloured injection (lake), the fluids are seen to intermix (under a power of 60 diameters), and the coloured particles to course along the vessels in all directions, the flow being facilitated by the pressure of the hand; but the most remarkable phenomenon is the long terminations of some of the veins in a *cul-de-sac*, and by pressure with the hand these may be elongated to a considerable extent, returning to their former dimensions when the pressure is removed. When the injection used is lake and water, a red capillary vessel is seen to surround these pouches, and often to cross them transversely at equal distances; a red vessel is also seen to surround the bunches of Malpighian corpuscles. It is possible that the appearance I have described may have been produced by the red particles of the fluid gravitating to the sides of these pouches; but careful and extensive experiments are required to determine this matter. The fact, however, that these large vessels around and about the Malpighian corpuscles, can be readily injected both through the artery and vein, is interesting and important.—*After note.*

See the Medical Times and the Dublin Journal on Medical Ethics. Reviews. E.G.

APPENDIX.

Containing an exposé of the numerous errors in the Prize Essay.

Before I proceed to the analysis of Mr. Gray's Treatise, a few preliminary remarks will be necessary for the proper understanding of the motives which have induced me to take this step; one, I believe, almost without precedent in medical literature. The reader has already drawn the most natural inference, viz.:—that I am a disappointed candidate, and therefore disposed to find fault with the adjudicators and with the successful Essay; the publication of my "Examination at the College of Physicians," will of necessity strengthen this notion. My answer is, that if a man goes before an examining Board, or if he competes for a prize, he is not a fit person to judge of his own competency, and provided the examination or the adjudication has been *legally* and properly conducted, he cannot with propriety make a public complaint, although he may feel that he has been unjustly treated. I published my examination at the College of Physicians because that examination was illegally and improperly conducted; and I thought also that it might in some degree tend to the advent of what I had long unreservedly advocated, viz., *public examinations; election by Concours*, and a *Faculty of Medicine.* I publish this *exposé*, believing that it will be for the benefit of future competitors for this Prize, that the injunctions in the will of the late Sir A. Cooper should be complied with—that the adjudicators should be the Physicians and Surgeons of Guy's Hospital—and that the Essay should be "original," and not the production of three or four individuals.

The Condition annexed by the Testator is, "that the Essays or Treatises
" written for such Prize shall contain original experiments and observations,
" which shall not have been previously published; and that such Essays or
" Treatises shall (as far as the subject shall admit of) be illustrated by pre-
" parations and drawings, which preparations and drawings shall be added

"to the Museum of Guy's Hospital, and shall, together with the Work "itself, and the sole and exclusive interest therein and the copyright "thereof, become thenceforth the property of the Hospital, and be trans- "ferred as such by the successful candidate."

"It is the will of the Founder that no Physician, or Surgeon, or other "officer, for the time being, of Guy's Hospital, or of St. Thomas's Hospital, "nor any person related by blood or affinity to any such Physician, or "Surgeon, or other officer for the time being, shall at any time be entitled "to claim the Prize; but, with the exception here referred to, this (the "Astley Cooper) Prize is open for competition to the whole world."

The word "*original*" is mentioned three times in the will, (with which the adjudicators are no doubt fully conversant). The interest of £4,000 was left, to use the words of the will, for the best "*Original Essay*" upon a given subject in Anatomy, Physiology, or Surgery. The six first subjects were named by the donor: further on,—"that the sum of £300 shall be paid to the author of such original Essay or Treatise." And then follow the conditions which are expressed above. The surplus of the interest of the £4,000 to be divided between the Physicians and Surgeons of the Hospital.

Without tiring the reader in *this* place with a long correspondence which I have had with some persons connected with Guy's Hospital, I may very briefly state a few facts in explanation. On the 20th August, 1853, the following advertisement, from Guy's Hospital, was sent to the Daily Journals, (not to the Medical Periodicals).

"ASTLEY COOPER PRIZE.—This munificent PRIZE, founded by the late Sir Astley Cooper, and of the value of 300 guineas, has just been AWARDED by the Physicians and Surgeons of Guy's Hospital to HENRY GRAY, Esq., F.R.S., of 8, Wilton street, Belgrave-square, for his Essay on the "Structure and Use of the Spleen." The prize, which was open for competition to the whole world, had many competitors, some of the Essays being of first-rate excellence."

On going to the Hospital to claim my preparations, I learnt from Mr. Shattock and others, that there were only two unsuccessful Essays besides my own, and I saw that one Essay was without a single preparation, and that the other had but very few. I thought after having read of the many competitors, and of the Essays of "*first-rate excellence*," that to use a vulgar, but expressive phrase, there was a little *humbug* in this; and when I saw after a few days that Mr. Gray had advertised the Astley Cooper Prize Essay "*On the Human* Spleen*" for publication, I felt anxious to see the Treatise, and I obtained permission by letter, of the Treasurer (Mr. Dobree) to see the Essay at the Steward's Office, but to my surprise, after waiting some time, I was told by Mr. Dobree that the Essay could

* Again advertised as the "*Human* Spleen."—*Feb*, 1854.

not be seen, the adjudication not having been completed. In answer to my letters, the adjudicators offered me a verbal explanation through Mr. Hilton, which I of course declined, and after several applications, the Treasurer on the 12th of August, 1854, nearly twelve months after the adjudication, again gave me permission to see the Essay; the Superintendent, Dr. Williams, having in reply to my letter, June 13, 1854, informed me "that neither the authorities of the Hospital nor the adjudicators of the prize felt at liberty to comply with my request." So that this Essay, contrary to the provisions of the will, was kept from the students of the Hospital and others for nearly twelve months; and one of the adjudicators had during that period the bad taste to exhibit the drawings (by Mr. Gray's artist) at a *conversazione* at his own house.

Before I commence my analysis of Mr. Gray's book, it is only just to him, to give the reader a sketch of the many laudatory notices the Treatise has received. The "*Lancet*," vol i. 1854, thinks it a most satisfactory, witness of the scientific anatomy of the "English School of Medicine." The "*Medical Times*," October 7, 1854, says "the work cannot fail to place its author among the first rank of European Anatomists and Physiologists."

In the "*Edinburgh Medical and Surgical Journal*," October, 1854, the reviewer has not an objection to offer; he speaks of "the faithfulness and completeness of research, and of the excellent sequel it forms to Mr. Simon's masterly Essay on the Thymus Gland."

The reviewer of the "*Dublin Quarterly Journal*," August, 1854, p. 156, forgetting Mr. Holmes' share in the compilation, and of Dr. Sanders' previous labours, 1851, thinks "the erudition and research truly astonishing, and that this part of the book is worth more than the £300." What an easy method of obtaining money! The writer winds up his general adulation, with a soliloquy on truth, to which I especially direct the reader's attention, p. 167. I have only space for a few lines. "How enduring and unalterable is truth once revealed in articulate and intelligible characters; cast forth to the living world, it weaves its symbols with the spirit of intellectual man.—Locked within the nervous grasp of generation succeeding generation, it endures co-existent with the physical spirit, of which it is the manifest offspring, ! !" &c. &c.

In the "*Edinburgh Monthly Journal of Medical Sciencc*," October, 1854, the reviewer, after objecting to some of the conclusions and short comings of the author, the want of details in the experiments, the non-disclosure of Dr. H. M. Noad's method of conducting his analyses, and the wisdom of Mr. Gray's not disputing with his imaginary opponents, sums up by

stating that "the volume has caused him some disappointment—that Mr. Gray has added but little to the histological facts described by Dr. Sanders—that the chemical analyses, too, require confirmation—that the fact that large veins originate from the Malpighian bodies is novel; and the reviewer hopes that the preparation from which fig. 42 is taken, is preserved in Guy's Hospital—that the book is worthy of the prize, but it is to be regretted that the author did not take a wider grasp of the subject—that great praise is accorded for the dissection of numerous animals, and for the accurate description of the form and size of the Spleen throughout the animal series."

In the *British and Foreign Review*, July 1854, p. 196, appeared the following notice, "In Physiology, Mr. Gray's work on the Spleen is by far the most valuable contribution to Physiology which the English school has produced for many years. The wonderful industry and ingenuity with which the enquiry has been carried out have led to brilliant results; but we must defer all comment till the next number." The review, however, which bears the signature of Dr. Carpenter, was deferred till January of the present year (1855). The reviewer at the onset admits the great merit of the work, but says, "Some of those very conclusions which Mr. Gray thinks he has most satisfactorily attained being to our mind the most problematical." The paper in the *Philosophical Transactions* on the development of the Spleen, and other ductless glands, is alluded to by Dr. Carpenter. In another passage, Dr. Carpenter says, "It is worthy of note that the mode of analysis adopted by Mr. Gray (Dr. Noad) is not stated. It is well known to all who have attended to this subject, that the proportions of fibrin, corpuscles, albumen, and salts, that may be determined to exist in any given sample of blood, will vary greatly according to the method which has been followed, and there is, perhaps, none that can be relied on as giving absolutely true results." The reviewer then alludes to Mr. Gray's assertion, that in splenic venous blood the red corpuscles do not amount to more than $\frac{1}{2}$, whilst, according to *Beclard*, they are $\frac{9}{10}$, as compared with ordinary venous blood; and that the statement that the blood of ill-fed, or starved horses, always affords a very considerable portion of fibrin, as compared with that of well-fed animals, is by no means consistent with Dr. Noad's analyses. But the most *pertinent* question of the reviewer is the following:—"What becomes of the solid matter thus kept back by the Spleen; for if the organ keeps back one-fifth of the solid matter of every pound of blood, the albumen, fibrin, and corpuscles, must soon nearly be exhausted?"

Dr. Carpenter, at the conclusion, builds up an ingenious theory of his

own, on the assumption that the splenic vein is destitute of valves; but unfortunately for the reviewer, the very animal, the horse, from which the blood was taken, has plenty of valves in the splenic vein, as I have elsewhere shown (p. 82). So much for physiology without correct anatomy. The words of Dr. Carpenter are,—"*The well known fact that the splenic vein is destitute of valves, seems to us to add some weight to this hypothesis.*" It will not be too much to expect a correction of this error in the next edition of Dr. Carpenter's Physiology.

Notwithstanding this flourish by the youthful trumpeter first quoted, it is but "*faint praise;*" and the author is advised to endeavour to attain to a satisfactory solution of these questions, and of others yet beyond, which may suggest themselves in the course of his further researches. The reader will, perhaps, ask with us, did Dr. Carpenter, and the other reviewers, know of the grant from the Royal Society, and that the paper and the drawings from the "*Philosophical Transactions*" had been exactly copied in this "*Original*" Essay, which was kept in the dark, except at the exhibition alluded to, for more than twelve months?

PAPER IN THE PHILOSOPHICAL TRANSACTIONS.

If the reader will refer to the "*Philosophical Transactions*" for 1852, p. 295, the paper read January 15, 1852, and received November 12, 1851, (thirteen months before the Essay was sent to Guy's Hospital, and 23 months after the subject of the prize had been announced by the adjudicators,) he will find a paper by Mr. Gray on the "*Development of the Ductless Glands in the Chick.*" *In the Prize Essay, Mr. Gray has copied the account nearly verbatim, or rather he has sent this published paper, with the six identical drawings* from the same wood engravings, as a part of the "original" Essay, thus proclaiming to the adjudicators, men of his own grade and position, that he is the author of the Essay. I ask why future candidates for this prize may not announce their names, and make use of their previous investigations, even if they have been published after the announcement of the prize, as in Mr. Gray's case? The names of most candidates are known to the adjudicators, and the occasional introduction of my own handwriting, in consequence of want of time, was quite sufficient to reveal my name; but the indelicacy of sending a paper previously published, must, I think, be apparent to every one.

The keeping this Essay, too, in the dark for more than twelve months, is another circumstance that should not pass unnoticed. The *Jacksonian* and the *Fothergillian* Prize Essays, with the drawings, must remain a

certain time in the libraries, that they may be examined by those who are interested in the subjects, before they can be removed; and at the College of Surgeons neither the Essay nor the drawings are allowed to be removed by the author; the reason assigned being, that they might be altered and amended. There is an especial reason, I think, why this rule should be observed at Guy's Hospital. Dr. Gull, as I am informed, in lecturing on the Thymus Gland, has said to the students, quoting from Mr. Simon's *curious* Essay on the Thymus Gland, " Gentlemen, these few words gained Mr. Simon the £300." Dr. Gull probably never took the trouble to ascertain their correctness, nor whether the air bladder of a fish, as supposed by Mr. Simon, performed the office of this gland? But this Essay, as I was informed, August, 1853, although published as the Astley Cooper Prize, had never been returned to the Hospital.

Another question is, who are the Physicians of Guy's Hospital? Why are the obstetric physicians excluded? Many subjects in these Essays would especially come within their province. I make no objection on this score, because if I had gained the prize, I should have been quite content with the adjudicators.

It may be asked, likewise, what constitutes an "*original Essay?*" How many may be engaged in its compilation? Should it be one person or a company; assuming *always* that the labors of a part of the firm are not acknowledged?

But there is another more extraordinary circumstance connected with this prize. In the *Literary Gazette* of this month, September 15th, 1855, is an account of the appropriation of grants by the Royal Society, and for the year 1852, is the following:—" To Henry Gray, Esq., for investigations concerning the Spleen, £100. The results of these investigations are published in an Essay on the Spleen, for which the triennial Astley Cooper Prize of £300 was awarded in 1853."*

I think this matter requires explanation. Three of the adjudicators were Fellows of the Royal Society, and must have known of this grant, and of the paper published in the " *Transactions;*" but they, like the three office bearers of the College of Physicians, who recommended the *Swiney Cup* to be given to Dr. Paris, will probably remain silent; it will be the " *more dignified course!*"

But let us now dismiss from our minds the above considerations, and enquire whether this Essay was worthy of the prize, had it been original,

* Does this aristocratic Society think that the prize was won in consequence of this grant? I intend to apply to the Council for a grant for exposing Mr. Gray's errors.—The reader will anticipate the result.

and the production of one person? Whether if, as the advertisement from Guy's Hospital stated, there were several Essays of first-rate excellence, this should have been selected?

In commencing this enquiry, I bear fully in mind the old adage of the *glass house*, and the many imperfections and errors in my own Treatise; and I again make the confession I did in 1852, p. 15, (although I have worked long and hard at the subject since that period) "that I scarcely have reached the threshold of the enquiry; and that if I endeavour to lift the veil from the pages of others, it is not without a feeling that much error may encumber my own;" and I may add another sentence, (page 15) "*that my belief was, that it was the intention that the gainer of the prize should draw his conclusions chiefly from his own experiments and observations, and that he should depend as little as possible, on the labours of others*"

Mr. Gray, in his preface to the *published* Essay, which I quote *verbatim*, acknowledges the assistance he has received from his colleagues at St. George's.

"This work, he says, was written in competition for the munificent prize endowed by the late Sir Astley Cooper, and the Adjudicators—the Physicians and Surgeons of Guy's Hospital—honoured the author by their decision in its favour.

"The author, during the progress of his work, received considerable assistance from many to whom he now begs to acknowledge his deep obligations.

"In the historical portion of his essay, he received much valuable assistance from his friend, Mr. T. Holmes, in the compilation of the statements and opinions of the ancient writers.

"For the large number of analyses of the blood of the Spleen, and of the Spleen itself, the author is indebted to his kind friend and most able colleague, Dr. H. M. Noad.

"The ultimate analyses of the Spleen, as well as some of those on the blood itself, were made by my friend, Mr. Henry Pollock, in the Laboratory of the St. George's Hospital Medical School, under the superintendence of Dr. Noad.

"The dissections recorded in the fourth chapter on the comparative Anatomy of the organ, the author owes to the liberality of the Council of the College of Surgeons, who permitted him to have the freest access to their valuable collection of store preparations.

"The author, in conclusion, begs to acknowledge his deep obligations to his esteemed friend, Mr. Athol Johnson, who has with much trouble revised the work in its passage through the press."

The preparations sent with the prize Essay, which may be seen in the ante-room of the museum of Guy's Hospital, (but Mr. Gray, I believe, has only alluded to four of them in the Treatise,) are from eleven different animals, viz.: man, cat, horse, sheep, hen, tortoise, turtle, snake, boa, frog and skate, in all 49, including Dr. Noad's chemical preparations. I

may remark that all the injections (so called), of the sheep's Spleen, are extravasations; but that the preparation which shows the lymphatics of the horse's Spleen is well worthy of examination. No microscopic preparations were sent with the Essay.

The drawings, commencing with those in the "*Philosophical Transactions*," include, I think, about 30 Spleens of different animals, besides the drawings in the Essay; some of them are well and truthfully executed, and I may add that the book (to use a trade phrase,) is well got up. I have not the pleasure of Mr. Gray's acquaintance, and he will probably have to thank me for giving the work greater notoriety, and for adding to its profits. If my views are erroneous, they readily admit of exposure, and the discredit will be sure to rebound upon myself.

Analysis of the work.—I pass over the historical introduction, which occupies 53 pages, as Mr. Gray acknowledges, that it is not solely his own compilation, and I may remark also, that Dr. Sanders in his Essay before alluded to, had gone over nearly the same ground.

Part II *(On the development of the Spleen,)* contains the paper from the "*Philosophical Transactions*," with the six wood-cuts before-named. This occupies eighteen pages; and, as I believe, notwithstanding the patronage it has received from the Royal Society, it is full of errors; for Mr. Gray (it will scarcely be believed) is ignorant of the situation of the Spleen in the bird, although he professes to trace its development from the earliest period. His investigations, however, were confined to the egg of the hen; but surely, after the grant of £100., he might have extended his enquiries to other classes of the lower animals, instead of supplying the adjudicators with the identical paper before published? He says (page 61) " The Spleen on the seventh day is in the same position as in the adult bird, occupying the space at the back part of the proventriculus;" and at page 296, on the Comparative Anatomy, he repeats, " that it occupies a similar position in all classes, being placed at the back part of the proventriculus, immediately above the stomach, and being held in its position by a delicate peritoneal fold." I have dissected many hundred birds, and therefore feel justified in speaking positively upon this matter. I have never found the Spleen in the situation described by Mr. Gray. It would be rather an inconvenient one, especially in birds of large swallow, although birds, like some other bipeds, have great capacity in this respect. In some of the passerine birds (all that I have examined with cylindrical Spleens), the organ is seated upon the gizzard, or to the right of the proventriculus, and the upper end sometimes curls under the proventriculus. In the moor-hen and coot, where the Spleen is behind, and to

the left side, it is upon the gizzard, not behind the proventriculus. But these are exceptions; and, as I have before stated, the Spleen in the vast majority of birds is on the right of the proventriculus, or between the cardiac orifices. Let the reader examine the next chicken (the bird in question) he may have ordered for his dinner! I may now fairly ask whether, after this *fundamental* error, it is probable that the inferences respecting the development of the Spleen are likely to be correct? It is said that the pancreas is developed behind the stomach, and that the Spleen makes its first appearance in a fold of the "intestinal laminæ," a small oval whitish mass seated near to the distal end of the pancreas. (p. 57.) I have not examined, like Mr. Gray, a series of hen's eggs in different stages of incubation, and therefore I cannot deny the correctness of his statement respecting the *chicken;* but in all the smaller birds that I have inspected, (p. 134,) as shewn by my drawings, the Spleen is first visible as a patch of red vessels in a mass of yellowish *blastema* between the two cardiac orifices. (See Plate 3.) In the mammalia, in reptiles, and in fishes, its situation is nearly the same as in the adult, but in the first (judging from those that I have examined) rather nearer to the stomach. Mr. Gray admits that Arnold states that the Spleen arises like the pancreas from the duodenum, and that Bischoff believes that it has its origin from a mass of blastema common to it and the pancreas, that, forming the pancreas proceeding from the duodenum, and that, forming the Spleen from the great curvature of the stomach. I believe the last opinion to be more correct than the others. I have never seen the Spleen in the smaller birds as figured by Mr. Gray in this Essay, and in the "*Philosophical Transactions*" (Fig. 3, page 58), a *round* or uniform mass between the 5th and 6th days of incubation. I pass over the blood vessels, pulp, and Malpighian bodies, believing that all these matters require further research, and that the development of the Spleen must be looked at in *all* classes of animals. In the human Spleen (p. 72) Mr. Gray, like myself, was unable to procure a fœtus at an early period, but he dates the probable development of the Spleen at about the third or fourth week; at the second month it is visible to the naked eye, and the size of a large millet-seed. If I have estimated the age of the fœtus rightly, the Spleen of which I have depicted in Plate 1, it is larger than this, but I may have been deceived in the age. A Table follows of the weight of the Spleen in 6 fetuses at 3, 4, 5, 6, 9, 9 months; the weights 1, 5, 18, 30, 60, and 210 grs. The comparative weights at the 5th month $\frac{1}{1400}$, 7th month $\frac{1}{700}$, and at birth $\frac{1}{350}$ (p. 76). Next, six children from 6 weeks to 10 years of age, average weight of Spleen 2 ozs.—Seventeen from 11 to 20

years, average weight of Spleen 5 ozs.—Twenty-eight from 21 to 30 years; average weight of Spleen 7 ozs.—Thirty-eight, from 31 to 40; average weight of Spleen 6 ozs.—Forty-six from 41 to 60; average weight of Spleen 5 ozs.—Eighteen from 61 to 82; average weight of Spleen $4\frac{1}{2}$ ozs.—General average weight as compared with the body, adult $\frac{1}{320}$ to $\frac{1}{400}$; old age $\frac{1}{700}$.

In this table the weight of the fetuses and children, is not given, and the cause of death is never stated, or the weight of the other viscera in old age furnished. On referring to my own averages (p. 50), it will be seen that in the fœtus especially, they differ materially from the above. Future observers must decide their corectness. I believe that the Spleen is not as Mr. Gray asserts, reduced to half its *proportionate* weight in early, and in adult life, (p. 76, 77, 80). The great difference of the weight of the Spleen of persons of the same age, is not, Mr. Gray thinks, altogether to be ascribed to individual peculiarity, but to the digestive process; this induced him to feed seven rabbits, and he found that their Spleens weighed 6, 8, $8\frac{1}{2}$, 10, $11\frac{1}{2}$, 7, 7, during the digestive process; but the Spleens of four rabbits starved, weighed only 3 grains (average). Neither the weight of the bodies of these rabbits, nor of the other viscera, is given; and the inference that because the Spleen is considerably diminished in size in a rabbit, it is likewise so in man, and other animals, is most fallacious, as my experiments (page 137) shew.

"In highly-fed animals the Spleen, during and after the digestive process, increases considerably" (p. 85). Why it should increase *after* the completion of the digestive process, it is, I think, difficult to conceive; and the Spleens of oxen and sheep highly-fed, as well as the other viscera, are *always* proportionately smaller, as I have repeatedly ascertained.

That there is a larger quantity of blood in the Spleen *during* digestion is highly probable, as I have stated at page 137; but it varies, I suspect, considerably in different animals, according to the nature of their food, form of stomach, &c.; but numerous experiments are required to determine this matter.

In the account of the structure of the Spleen there is nothing worthy of notice (p. 86 to 105); microscopists, like lawyers, could readily get up a long controversy on muscular fibre-cells, and other matters, but it would lead to no practical result, more especially as our eyes and microscopes are not the same. In speaking of the fibre-cells in the external tunic, Mr. Gray says, "They are not to be found in the human subject, rabbit, horse, ox, guinea-pig, hedge-hog, and some others, but they are found in the pig, dog, and cat." Let me ask the common-sense reader whether it

is likely that nature would have so varied the structure in animals of the same class? (horse and pig, *e. g.*) Kölliker also remarks (p. 772, before cited), "That muscular fibres are present in the capsule of the human subject, the cat, Dicotyles torquatus, and ass," but he found them absent in the horse, ox, hedgehog, guinea-pig, and bat.

The result of Mr. Gray's experiments respecting the contractility of the Spleen nearly squares with my own (p. 41), except that he observed a slow and faint contraction on the application of the galvanic current.

In speaking of the blood vessels, the author asserts "that the size of the branches of the splenic artery are very considerably larger, perhaps, than are distributed to any gland of its proportionate size excepting the thyroid." The kidney, a gland about one-third less than the Spleen, has a larger supply of blood; I question too the correctness of the comparative vascularity of the thyroid? It must be recollected that in many animals the branches from the splenic artery to the stomach and pancreas exceed in volume the terminal branches to the Spleen; and Mr. Gray's constant allusions to the comparative size of the branches of the cœliac tripod in the lower animals are entirely useless, unless the number and size of those furnished to the stomach are likewise given.

In the account of the splenic vein it is remarked, "that this vein is the largest of all the branches of the *vena portæ*, and like them *is destitute of valves*, possessing a diameter considerably greater than the splenic artery, the proportion being as five to one or two, not only in the trunk, but also in the branches."

Mr. Gray, it will be observed, was entirely ignorant of the existence of valves in the splenic vein in any animals; and he has altogether overlooked the beautiful valvular arrangement in the human subject at the junction of the large branches, so that regurgitation of the blood is to some extent prevented; but I shall have to speak hereafter of the effect this ignorance of the presence of valves in the splenic veins of the horse, bears upon Dr. Noad's analysis of the blood of the splenic vein (so called).

The veins are said to terminate, "1st. in the arteries (capillaries); 2nd. by intercellular spaces, by which the veins communicate with each other, and by distinct cœcal pouches."

The most interesting part of this chapter is the allusion to the cœcal pouches or bulgings in the vein, noticed before, as Mr. Gray admits, by *Krause, Poelmann, Hyrtl*, and more lately by *Ecker*. When I sent in my Essay I was entirely ignorant of the existence of these pouches (having read but little about the Spleen), but subsequent investigation has enabled me to make some important additions (I *think*) to the remarks of

Ecker and others. These will be found at page 174. The reader may compare the account given by Mr. Gray with the above, and judge for himself.

The blood of the Spleen occupies nearly 100 pages, and Mr. Gray admits that "*it forms the most important part of his subject.*" (p. 137).

"A table of the blood obtained from the splenic-vein of 12 well fed, 2 ill-fed, and 3 starved horses, (p. 140); the weight of blood in the first, obtained from the splenic-vein, in grains, was—well fed, 2,808, (6 ozs. 168 grs.) 2,225, 1,529, 1,500, 1,371, 2,369, 2,641, 2,446, 2,415, 895, 900, 724; ill-fed, 816, 371; starved, 60, 50, 75."

Neither the weight of the horse nor of the Spleen, the disease of the animal, nor the mode of death, are mentioned; all most important in well directed experiments. Take experiment 3, (p. 140): "In a well fed horse (under chloroform) 9,000 grs. of blood (20 ozs. 20 grs.) were obtained from the splenic-vein." How much from the stomach?

But let me ask, was the blood thus obtained from the splenic vein, *from the Spleen?* Is it likely that the valves, (of which Mr. Gray and his colleagues were entirely ignorant,) were not performing their proper office? Let the reader turn to my account of these valves in the Horse, (page 82,) as described in the original Essay, and as shewn in the preparations; let me, however, add a more minute account of the arrangement of the abdominal veins of the horse, and if this account be correct, the analysis of the blood by Drs. Noad and Pollock, must be utterly and entirely useless, because the blood of the splenic vein *alone* could not have been obtained; and the adjudicators, *if they read my description of these valves, and examined my preparations, must have known this!*

I request the reader to refer first to Plate 4, figure 1, which shews the arrangement of the coronary and splenic veins of the horse, and then let me beg his attention to the following description. The vein (1) runs along the under and inner surface of the Spleen from the base forwards to the apex. It receives six large veins from the stomach, three of these near to the smaller end, and all furnished with valves to prevent regurgitation of the blood. In this specimen, a pair of valves exist near to the junction of the main trunk, and that from the base of the Spleen; (2) and another pair near the entrance of the last coronary. The pancreatic, (4) is furnished with one pair of valves; and the mesenteric vein, (5) and its smaller branches are also abundantly supplied with them. The renal veins likewise contain one pair of valves in each. The number of valves will vary very much in different specimens; but in the one I am speaking of, probably not less than a hundred pairs of valves were present in the abdominal veins.

It is at once apparent, therefore, as I have said before, that this blood, supposed by Mr. Gray and his colleagues to have been the blood of the Spleen, was in reality partly from the stomach; the result of their analyses is consequeutly null and void.

" In the microscopic examiuation of the venous blood of the Spleen, as compared with other venous blood, the differences are, variations in size, form, and colour of the blood discs; the existence of small blood discs contained in cells, pigmentary matter, and a considerable number of *colourless* corpuscles, and these are said to be peculiar to the splenic venous blood." (p. 145.)

That these changes are often more abundant in the blood of the spleen of some animals I do not deny, but they are not peculiar to this blood; the so-called blood discs included in cells may be seen in the liver and kidney; and the pigment granules I have found in many animals, (reptiles, and fishes especially,) both in venous and arterial blood, and the transitions spoken of are not confined to the Spleen; the colourless corpuscles are frequently very abuudant, but in many animals I have failed by microscopic examination to detect the slightest difference between the blood of the splenic vein and that of the artery, more especially in the human subject; my examinations, it should be added, were not generally made on fresh Spleens, and therefore my conclusions may have been erroneous. I refer the reader to page 174 for my subsequent investigations respecting this matter.

I now come to Dr. Noad's chemical examination of the blood, (p. 152,) but as the mode of analysis is not given, I refrain from commenting upon this subject, observing with Dr. Carpenter, that the proportions will vary greatly according to the method which has been followed, and " that none can be relied on as giving absolutely true results." The result of the 41 analyses is that the solid matter in the splenic venous blood was only 187.1 per 1,000, in the jugular venous 201, and iu the arterial 239." The opinions of Beclard and Funke differ essentially from the above; the latter found more blood-globules in the blood of the splenic vein than in the artery, and other observers disagree materially upon these points. But, as I have said before, the kind of food, quantity of drink, condition and size of the Spleen, and more particularly the disease of the animal, may all considerably influence the result of the analysis; these must be fully stated in future experiments, *and the blood of the Spleen only, must be used.*

Comparative anatomy of the Spleen.—In this part of the subject, Mr. Gray's anatomical and physiological blunders are so numerous, that they

could not have escaped the notice of some of the adjudicators ; the very basis of his inference is false, as my tables and preparations demonstrated. Mr. Gray says, "*that the Spleen is an organ of large size in the more highly organized vertebrata, and that as we descend the scale of the vertebrate series, the function of the Spleen appears to be considerably reduced in importance, as shown by the extreme diminution of its size, a diminution more marked in some of the bodies of the reptilia, than in any other of the vertebrata (pages* 303, 308, 321.) *That in fishes the Spleen is universally present, but its small size in proportion to the body, shows that it is an organ of less functional importance than in the mammalia," (p.* 321.)

The following is Mr. Gray's table, shewing the proportion the Spleen bears to the entire body in the various classes of animals:—

"*Mammals.*—Lemur, 256; Bat, 87; Lion, 264; Fox, 226; Kangaroo, 716; Squirrel, 211; Moschus Moschiferus, 256; another specimen of the same, 256; Rat, 226; average, 1 to 277.

"*Birds.*—Puffin, 5,040; Oyster Bird, 4,920; Ostrich, 3,673; Spoonbill, 2,560; Owl, 2,160; Pheasant, 960; Cormorant, 553; Water-hen, 1,324; average, 1 to 2,838.

"*Reptilia.*—Frog, 1,364; Toad, 1,589; Snake, 11,150; average of the two first, 1 to 1,492.

"*Fishes.*—Herring, 3,258; Whiting, 2,159; Mackerel, 2,000; Eel, 1,638; Flounder, 1,600; average, 1 to 2,131."

As this table forms the text of the author's deductions, I beg of the reader to examine it carefully, and I may remark that the average of the birds given, should have been 2,648, instead of 2,838; an error of no great importance. The table professes to shew the proportion the Spleen bears to the body in "*the various classes of animals,*" but strange to say, in the seven orders of mammals, only six are named,—in the six orders of birds, only four,—and of the passerine, birds with Spleens proportionately larger than the others, and which are more numerous than the other orders united, not a single example is adduced.—Of reptiles, only two of four orders are named; and of the 25 orders and families of fishes, only five families are quoted (one of each).

The reader must compare the above with my own table of general averages, (p. 24, 28, and 133) and some important differences will be found, more especially in the bat, lion, reptiles, and fishes. Mr. Gray throughout the whole work looks to the Spleen alone; the weight of the body and of the other viscera is never given; and if these viscera had been microscopically examined, many of the changes which Mr. Gray thinks peculiar to the Spleen would have been found in them.

I will now take the various classes and orders mentioned by Mr. Gray, and point out what I believe to be some of his inaccuracies. The paragraph on the Quadrumana requires no comment. In the *Cheiroptera*, the difference between the size of the Spleen of the fruit-eating bat and of the insectivorous is pointed out; but the bat, with a Spleen bearing the proportionate weight of $\frac{1}{87}$ to the body, is a rare exception; and the *Galæopithecus* is not solely a fruit-eating bat, but lives on insects and other animals. *Carnivora.*—In the otter, judging from four specimens I have examined, one end of the Spleen was not twice the breadth of the other, (see Plate 2, Fig. 35) nor was the Spleen of the Ichneumon divided into two lobes (Plate 2, Fig. 40) in four that I have inspected. This was an accidental division as in the wild cat, (Plate 2, Fig. 44) probably from violence. In the Ichneumon, Mr. Gray says, "it is a fact worthy of notice, that the branches which pass to the substance of the Spleen are very much smaller than those which pass to the *stomach* or even to the pancreas." But this applies, besides the lion and the leopard also named, to numerous animals of this class, and the common cat affords a good example (Plate 3). It is not a *singular peculiarity*, as stated by Mr. Gray. The assertion that the Spleen is much larger in the *felidæ* than in the other order of the *carnivora*, is falsified by Mr. Gray's own table, where the proportionate weight of the Spleen in the lion is 264, of the fox 226. In six lions that I have examined (p. 70, 72, 134) the proportionate weight in the adults, the bodies of two of which were weighed, was about 623, 594, 611, 477; and in the two lions at birth 360, 371.

Amphibia.—In these animals (not strictly amphibious), it is said, "that the Spleen presents a more perfect adaptation to its function as a reservoir for blood than in other members of the Mammalia." The splenic veins are very large, but Mr. Gray, I think, is mistaken in supposing that the Spleen is required as a reservoir for blood, more especially in what he calls amphibious animals, as I shall have occasion to mention hereafter. The Spleen of the mole, an animal that lives under ground and avoids the water, is relatively double the size of that of the seal.

Marsupiata.—The conclusions are entirely wrong respecting the Spleen in this class. Mr. Gray says (p. 281), "The Spleen of the *Carnivora is of very considerable size;* but in all the Marsupials that he has dissected, excepting the Ursine Opossum, he has found it of *very small* size." If my table of averages is referred to (p. 133), it will be seen that the *Marsupiata* have larger Spleens than the majority of the *Carnaria.*

Rodentia.—In this class, again, Mr. Gray's conclusions are upset by his own evidence, *as on many other occasions.* In his own table of the nine

quadrupeds named, the rat and the squirrel have the largest Spleens, excepting the bat; and yet we are told (p. 283) " that the Spleen in almost every member of this order *(Rodentia)* appears from its exceeding small size to be reduced in importance, as compared with many other genera of the Mammalia." With the exception of the hare and rabbit, animals not mentioned by Mr. Gray, the *Rodentia* have larger Spleens than most of the other classes, as my tables shew.

Edentata and *Monotremata.*—In the *Ornithorhynchus* the Spleen is stated to be of very considerable size, and the reservoir function, like that of the seal, is again alluded to; but as I have said elsewhere, the examination of animals in spirits may lead to many fallacies. The Spleen of the *Ornithorhynchus* that I examined in the College store-room was very thin, long, and lax; and if my estimate (p. 81) is correct, the relative weight to the body was about $\frac{1}{469}$, nearly double that of the common rat.

Pachydermata.—The horse, peccary, and hyrax were only dissected in this class, and the short description offers nothing for comment.

Ruminantia.—Mr. Gray appears to be ignorant of the *important* fact that the Spleen in this class is generally attached closely to the diaphragm, and to the paunch. In the genera *antelope* and *cervus*, he says, " it is situated about the centre of the left side of the stomach." The attachment to the diaphragm, as I have stated, (p. 88,) is a circumstance I believe of physiological importance, and the Spleen in the ruminants is not seated in the centre of the stomach; nor does the splenic artery enter the Spleen "*as a single branch without subdivision* in all the ruminants." In the rein-deer, in the llama, guanaco, and in one species of goat that I examined, the artery divided into three branches before entering the Spleen. (See preparations.)

Cetacea.—In this class (p. 21) a curious distinction is made between these animals and the *Amphibia;* the Spleen in the former is supposed by Mr. Gray to be of exceedingly small size, whilst that of the *Amphibia* is very large, the extensive venous and arterial reservoirs in the *Cetacea* compensating for the smallness of the Spleen. I believe that under certain conditions of lung in the human subject, and in the lower animals, that the Spleen becomes both temporarily and permanently enlarged, and that it is a reservoir for blood; but it is questionable whether it often performs this function in the diving animals; in which, owing to the peculiar structure of the lungs, and to the larger size of some of the veins, such an office would not be required. Besides, only a few of these animals can remain but a short time under water, (I speak of those often alluded to by Mr. Gray, the water-rat, the moor-hen, corvorant, &c.,) and if blood were

driven into the Spleen, it would not, I think, be quickly restored to the circulating current. Let me now quote Mr. Gray's conclusions on the *Mammalia.*

"The chief results observed in these investigations are: The large size of the spleen in all the members of this class as compared with the other vertebrata. This is seen by comparing the tables illustrating the relative proportion which the organ bears to the entire body in each, presenting its maximum of development in this class, in connection with the greater general completeness and requirements of their organization. Amongst these the spleen has a much larger proportional size in the carnivora and insectivora than in the remaining orders. It is consequently largest where the intestinal canal presents (as in the above-mentioned genera) the least complex structure, where digestion is most rapidly performed, and consequently where the new material is more suddenly added to the blood. Lastly, in the amphibia, its large size and its peculiarly lax and distensile texture are in perfect harmony with the requirements of the animals of this class, being peculiarly adapted as a reservoir for the blood which accumulates in the venons system during the suspension of respiration."

I believe all these conclusions to be erroneous, indeed if such evidence is admissible, the meagre tables referred to, prove them to be so; and the fallacy of the assumption that digestion is most rapidly performed in a carnivorous animal, will be apparent to the merest tyro in the profession.

Birds.—I will quote Mr. Gray's own words in describing this class (p. 295.)

" In numerous dissections that I have made of the spleen in birds, I have not found that its general anatomy differs to such a degree (except in that of form) in any of the various classes as to warrant a separate description of the organ in each class. The description that I shall now give will apply to all; at the same time I shall mention any individual peculiarity that may be worthy of notice.

" The Spleen of birds is generally of small size as compared with the body, much smaller than in the mammalia, as is seen from the accompanying table. (See p. 273.) Its form is usually somewhat spherical, as in the cormorant *(phalacrocorax gracilis)* the owl, the puffin *(mormon fratercula)*, the oyster bird *(hæmatopus ostralegus)*, the spoonbill *(platalea leucorodia)*, and some others. In the Virginian owl *(bubo Virginianus)* it is conical, and in the ostrich *(rhæa Americana)* and moor-hen *(gallinula chloropus)* cylindrical. Its size, though small, is subject to great variation in certain classes. I have found it *largest* in the rapacious cormorant, an interesting circumstance in connection with its large size; in the mammalian carnivora; it is also large in the diving moor-hen. It occupies a similar position in all classes, being placed at the back part of the proventriculus, immediately above the stomach, being held in its position by a delicate peritoneal fold. Corresponding with this diminution in the size of the Spleen, its blood-vessels become considerably reduced in importance, and instead of forming one of the chief branches of the cœliac axis, they are derived entirely from one of the *branches* of that vessel (the gastric), previous to its distribution to the stomach, liver, duodenum, and pancreas. The *splenic vein* also is not, as in the mammalia, one of the *main* trunks of the vena portæ, but consists merely of three or four *small branches*, which open into the gastric, the vena portæ being formed by

the junction of this vessel and the mesenteric vein. In the *water hen* it consists of a *single* long trunk, which is larger than the smaller branches combined in other birds. This peculiarity in connection with the somewhat larger proportional size of the Spleen may have some relation to the peculiar habits of the animal, which involve a considerable retardation to the blood during its impeded respiration under certain circumstances."

I have already alluded to the error respecting the situation of the spleen in birds, and I may here remark that the moor hen has not a cylindrical spleen, (Plate 2, fig. 260) and that the relative weight of the spleen, in twelve specimens which I have given at page 108, shews that the passerine birds have much larger spleens than the moor hens; and in Mr. Gray's own table, the relative weight of the pheasant's spleen exceeds that of the moor hen by one-fourth.

I pass over the microscopic description of the various parts of the Spleen, as I believe Mr. Gray's account is very similar to that given by some previous enquirers. I could get up a long controversy upon many subjects, but I had rather confine myself to the more tangible points that may be determined by the generality of my readers:—as one example of the necessity for a microscopic dictionary, I quote a part of Mr. Gray's description of the spleen-pulp of birds, page 300.

"3rd. Nucleated vesicles very rarely exist as forming part of the contents of the Malpighian vesicles. They occur occasionally very sparingly, and consist of an external membrane, containing on its wall a circular nucleus, with one or two distinct circular nucleoli, the cavity of the vesicle containing a few variously shaped granules."

Reptilia.—The introduction to this class is the following:—

"As we descend the scale of the vertebrate series, the function of the Spleen appears to be considerably reduced in importance, as shown by the extreme diminution in its size, a diminution more marked in some of the orders of this class than in any other of the vertebrata. And these facts are highly important, as they clearly show what experiment on the higher animals has confirmed—namely, that the Spleen is an organ not absolutely necessary for the perfect performance of the functions of life, but that it is an organ superadded, and existing of large size, in the more highly organized vertebrata, where its function is brought into play to *balance* and *regulate* the ever varying conditions of the *vascular* and *nutritive* systems."

Chelonia.—Notwithstanding the above statement, Mr. Gray says, "in the turtle the vein is at least *ten times* larger than the artery," a fact surely not indicative of the diminished functional importance of the Spleen? In the *Chelonia,* the Spleen is said to be larger than in the remaining orders of reptiles; and in the *crocodilus biporcatus* it is of larger size than in many other reptilia.

Before perusing this part of my subject I must request the reader to turn to page 119 of this Treatise, where I have quoted the opinions of

Cuvier and Meckel, respecting the Spleen in the *Ophidians*, and where I have stated, that in some instances I probably mistook the Spleen for the pancreas, or weighed these organs together; a circumstance easily accounted for, if the reader will examine figures 298, 299, 300, 308, 309. Plate 2, of this Treatise.—Mr. Gray gives the following account of the *Ophidia* :—

"The most extreme differences of opinion appear to exist with regard to the *presence* or *absence* of the Spleen in this class; Cuvier asserting its existence to be constant in all the members of this group, whilst Meckel, on the other hand, totally denies that any organ exists in the ophidia, analogous to the Spleen of mammals. Such great diversity of opinion among authorities so high, led me to adopt the greatest caution in examining the truth of one or the other of these statements, and it is only after the most scrupulous and careful investigation, assisted by the unerring test of the microscope, that I am enabled to confirm with *absolute certainty* the above opinion of Cuvier, that the Spleen does exist in the present class. I have dissected this organ in two specimens of the *boa*, in the *hydrus*, *coluber natrix*, *viper*, *(vipera communis)*, the *common ringed snake (natrix torquata)*, and in the *typhlops*, *amphisbœna*, and *anguis fragilis*, where the Spleen presents in all a somewhat analogous form. The organ is very small, bearing a proportion to the whole as 1 to 11,150, hardly exceeding in the large boa the size *of a pea*. Its form is irregularly circular, and its surface somewhat lobulated; it is placed on the left side of the pylorus, just at the commencement of the intestine, being partly retained in its position by its attachment to the mesenteric peritoneal fold, and also by its intimate connection with the pancreas, immediately above which it is placed. I have no doubt that it is the close connection this organ has with the pancreas that has given rise to the differences of opinion as regards its existence."

With regard to the above paragraph, I believe the *coluber natrix*, and the *natrix torquata*, to be one and the same reptile; that in this snake, admitting that Mr. Gray is right respecting the Spleen, the organ is proportionately larger than he has represented; that the Spleen and pancreas are seated in this, as in nearly all the Ophidians, on the *right* side of the intestinal-canal, and not on the *left;* and that Meckel does not totally deny its existence in the *Ophidia*, as the extract I have quoted, page 119, shews. Again, Mr. Gray is most unhappy in his descriptions; in the *Anguis fragilis*, (slow-worm), he says, "the Spleen is about the size of a large pea, placed above the pancreas, on the right side of the pyloric end of the stomach." This reptile seldom exceeds 300 grains in weight, and if this account were correct, it would have a larger Spleen than any animal mentioned in Mr. Gray's table. The Spleen, too, as I have shewn, page 122, and figure 299, Plate 2, is on the *left* side, the *pancreas* on the right; the saurian character of the Spleen, and its darker colour in this reptile, rendering it almost impossible to mistake it. Mr. Gray endeavours to account for the small size of the Spleen in Ophidians, from

the food not being so rapidly digested, the process extending over days, and even weeks, whilst in the *Carnivora*, he says, it does not extend over more than a few hours.

Batrachia.—The jumble and eonfusion in this elass is most extraordinary. The Spleen of the toad is said to be "the size of a large pea, and plaeed behind the stomaeh, in the mesenterie peritoneal fold, whieh conneets the small intestine, three or four inehes from the pylorus, with the spine, and elose to the distal end of the panereas. Corresponding with the small size of the Spleen in this order, the size of the nutrient vessels beeomes mueh diminished, &e. In the frog the structure is the same." As the panereas in the toad has three lobes, its distal end is rather a strange expression; and as for the spaee being three or four inehes from the pylorus, the disseetion of a toad or a frog will readily reetify this error. The Spleen, too, in both these reptiles is always seen on the *right* side of the stomaeh. But the most eurious and important error is the following, whieh is thriee repeated, viz., that "in the *Batrachia* the veins on the surfaee of the Spleen do not form a plexiform net-work, as in the *Ophidia* and *Chelonia*." If the Spleen is injeeted with *thin* paint, the inoseulations on the surfaee are very evident, as my preparations shew.

The emerging blood of the Spleen of the frog is said to eontain a rather larger number of white eorpuseles; but looking at the shortness of the veins it is rather diffieult to obtain this blood.

In the *perenni-branchiate Amphibia (the only true Amphibia)*, the Spleen was disseeted in the *axolotl*, *siren*, and *proteus*; and Mr. Gray says, "In the *former* animal, where the branehial tufts remain persistent, the Spleen is small; whilst in the others, where this arrangement is exaetly reversed, the Spleen presents a large proportional size." But how does this square with the deseensive seale, and with the digestive funetion, the last mentioned animals living in a state of nature half the year without food?

From the above statements, Mr. Gray's eonelusions (p. 320) respeeting the Reptilia must be erroneous. The Spleen is not in the *Chelonia*, *Loricata*, the *Sauria*, and the *Batrachia*, and in some of the *Ophidia*, (slow-worm, e. g.) "*of extremely diminutive size;*" and as I have before remarked, the ereeping toad has a Spleen proportionately larger than the swift-running hare.

The inferenee, too, that the Malpighian eorpuseles are absent in this elass is entirely wrong, for in the *Chelonia*, *Loricata*, and some of the larger *Sauria* they are very prominent; the theory therefore promulgated (p. 321) falls to the ground.

I pass by the minute anatomy of the Spleen in the reptilia for reasons

before named, and I may remark again, that the changes described by Mr. Gray are not peculiar to the Spleen.

Fishes.—Mr. Gray remarks:

"The Spleen in fishes is universally present, but its small size, in proportion to the body, shows that it is an organ of less functional importance than in the mammalia."

"In the *osseous fishes*, I have dissected it in the carp *(cyprinus)*, whiting *(merlangus)*, flounder *(platessa flesus)*, herring *(clupea harengus)*, mackerel *(scomber)*, eel *(anguilla)*, cod *(gadus)*, pike *(esox lucius)*, salmon *(salmo)*, bream *(brama)*, tench *(tinca chrysitis)*, perch *(perca fluviatilis)*, and roach. And in the *cartilaginous fishes*, in the dogfish *(scyllium)*, basking shark *(selache maxima)*, and lepidosiren. In the lamprey *(petromyzon)*, the existence of the organ is questionable; it certainly does not occupy the position in which it is found in all other fishes. In the lancelet the organ is unquestionably wanting."

"The proportion that the weight of the Spleen bears to the body is in the herring as 1 to 3,258; in the whiting as 1 to 2,159; in the mackerel as 1 to 2000; in the eel as 1 to 1638; and in the flounder as 1 to 1600. The results of these proportional weights not only serve to show, as above stated, the diminished functional importance of this gland, but a proportional weight about equal to what the same gland possesses in reptiles and birds, and which is, as we have already seen, considerably less than in the mammalia."

The erroneousness of the above statements is shown by my own tables; and the assertion that the Spleen is universally present in all fishes, and that its existence is questionable in the lamprey, and its absence in the lancelet certain, but ill accord. In the specimen of the skate that I dissected, the Spleen was not in lobules, as stated by Mr. Gray, (p. 322,) (prep. 129); the description of the supposed Spleen of the lamprey, and its large size (if correct), militate strongly against Mr. Gray's main conclusion.

In the minute structure of the Spleen of fishes, the pigment granules, the supposed disintegration of blood-corpuscles, the corrugation and wrinkling, and the crystals, are not peculiar to the Spleen; the darkish coloured points, too, which are said to have apparently some analogy to the Malpighian bodies of the higher *vertebrata*, and to be *peculiar* to the Spleen (p. 330), are abundantly present in the skin, kidney, liver, ovaries, testicles, upon the heart, and along the course of the blood vessels in many fishes and reptiles; but the reddish or yellowish masses are generally more numerous in the Spleen, and sometimes, though rarely, confined to this organ.

There is another fact respecting fishes that does not at all square with Mr. Gray's conclusions, viz.:—That these animals are very voracious, and that their food is quickly digested. I have caught a Pike with one of its own species, about half its size, partly in the stomach and œsophagus, the tail projecting from its mouth. I have known a Trout kept in a tank, and weighing about 2 lbs., swallow another Trout six inches in length, its

own length being 18 inches. The same fish would consume a hundred minnows per week. The Grey Mullet, with a very large Spleen, (judging from one specimen,) and a fleshy gizzard, is a very voracious fish, and partly a vegetable feeder. The Carp, also, almost exclusively a vegetable feeder, has a larger Spleen than many carnivorous fish. Moreover, no animals increase so rapidly in size as fishes; a fact of great value in estimating the *relative* size of the Spleen in these animals.

Mr. Gray says,

"The chief results that have been obtained from the present investigations on the comparative anatomy of the Spleen are as follow:—

"1st. The Spleen exists without exception in all vertebrate animals.

"2nd. It presents, however, by far its greatest development of structure, and consequently its function is most perfectly exercised in the mammalia, this being partly dependent upon the greater general completeness and requirements of their organization.

"3rd. Part of the offices of this organ are plainly those of a diverticulum for blood. This is especially seen in the diving animals, where its large size is undoubtedly associated with the considerable obstruction to the circulation which takes place under these circumstances. Its large size, also, in those animals in which assimilation of food *rapidly* occurs, and in which consequently new material is suddenly added to the circulation, as compared with its extremely diminutive size under the opposite conditions, also affords evidence of its diverticular function.

"4th. The total absence in reptiles and fishes of one of the main elements of this gland in mammalia and birds is in perfect accordance with their low grade of organization and the remarkable faculty they possess of sustaining hunger for almost an unlimited period, whilst in the former they form a ready, although a scanty, sinking fund for albuminous materials, that can be rapidly given up to the blood during their temporary and occasional abstinence, and which cannot be borne by them with impunity for any long period.

"5th. Its function, then, is not for specific, but for general purposes, serving to regulate, under many varied and opposite conditions, the quantity and also the quality of the blood."

I have, I *think*, satisfactorily refuted all the evidence adduced in support of the first four conclusions; indeed, the examples given by Mr. Gray, and more especially his own tables, do this to a great extent. The last proposition I shall notice presently.

Part V.—Physiology of the Spleen (p. 339.)—It will be remembered that my own conclusions respecting the use of the Spleen are not very dissimilar to those of Mr. Gray, but that neither of them are *novel.* Mr. Gray, however, almost entirely overlooks the connexion (the most important one) between the Spleen and the liver, a connexion proved beyond a doubt by the valves I have described in many animals, and by the valvular arrangement of the mouths of the veins in most of the other classes of the *vertebrata.*

Mr. Gray further remarks, p. 350, "Its use then is a reservoir for

blood, a safety valve, not to any particular system of vessels or to any organ, but to the system generally, to the general circulation."

Mr. Gray and myself both believe that the Spleen is a *reservoir* for the blood of the system generally, but I think that it has *also* a *special* relation to the stomach and liver. I moreover believe, that the illustrations respecting the diving animals are inapplicable and false, and as examples of this, I may name the relative weight of the Spleen of the water-rat (an animal quoted by Mr. Gray), and that of the land-rat, (p. 80). In the latter, the average proportionate weight of the Spleen, in ten specimens, was $\frac{1}{229}$; of the former, in nine specimens, $\frac{1}{710}$; the small size likewise of the Spleen in many of the diving birds, as shewn in the table of averages, (p. 133), is a complete refutation of this theory; the reservoir function as I have shewn at page 190, is not required in the Spleen of these animals.

As regards its other supposed office, I do not believe, with Mr. Gray, that the Spleen is for general purposes alone; nor do I think, judging from the effects of extirpation, that it influences *much* the quality or quantity of the blood. That the Malpighian corpuscles secrete an albuminous material I think is tolerably certain, and that the Spleen performs a part in the process of sanguification is also I think proved; but what that exact process is I must at present express my ignorance of, although I feel that the matter is nearly within my grasp. The Spleen can neither be *solely* a blood-forming, nor a blood-destroying organ, but I am *now* less surprised that *Bennett* and *Kölliker*, should have arrived at such opposite conclusions, more particularly where the Spleen is specially examined; for in some instances there appear to be evidences in support of both theories, and as the blood corpuscles are formed and probably destroyed in some parts of the body, both these changes may take place in the Spleen as well as in other organs.

But let me return to the physiological rambles which terminate the book. A great portion of these thirty-two pages is occupied in inferences from, and allusions to, the analyses of the blood (so called) of the splenic vein; but as I have shewn (p. 186) the blood of the stomach was also analyzed, and therefore it would be waste of time to allude again to this part of the evidence. The sum and substance of Mr. Gray's conclusions is, "*that the Spleen regulates the quantity and quality of the blood,*" a proposition by no means new, and one which I do not deny, but I think that Mr. Gray has an odd way of proving it. In one of the concluding pages there is a bare allusion to extirpation of the Spleen, and Mr. Gray admits (p. 370) that two cats from which he had removed the Spleen

improved much in condition, and grew to a much larger size than other cats of the same age where the organ was intact. The explanation given is the following—"The results of the comparative anatomy of the gland have shewn that its extreme diminution in the lower vertebrata is in harmony with the decrease in its functional activity, and the more limited use that the organ performs; whilst its minute size in the ophidia shews that its use can be of little, if indeed of any importance, in this class."

Surely Drs. Noad and Pollock might have given us the analyses of the blood of some of the spleenless cats that were running about St. George's Hospital? They could not in this instance have made a mistake, although it is possible that like the man and the golden egg in the fable, the examination would not have added to their means!

H. TEAPE & SON, PRINTERS, TOWER-HILL.

ERRATA.

Plate 3, Fig. 44, the Malpighian corpuscles of the Spleen of the Leucoryx, injected with thin white paint.

Page 15, line 30, omit *of error* after veil, and insert *error* after much, in line 32.

Page 24, line 11, for *Chieroptera* read always Cheiroptera.

Page 31, line 17, for *Palmipides* read Palmipedes.

Page 46, line 21, for epithetial read epitheleal.

Page 65, line 14, for *tardigrda* read tardigrada,

Page 66, line 41, for *Togue* read Toque.

Page 71, line 42, for $33\frac{1}{2}$ *lbs.* read $31\frac{1}{2}$ lbs.

Page 77, line 6, for 1-375 read 1-379.

Page 79, last line, and page 80, line 47, for *Cabybara* read Capybara.

Page 84, line 15, for *echynococci* read echinococci always.

Page 84, lines 19 and 23, for cœcum and cœcal always read cæcum and cæcal.

Page 123, line 46, for *Tree-fog* read Tree-frog.

Page 129, line 26, for *appears* read appear.

Page 131, line 54, a comma after blood globules.

Page 144, line 25, for *prep.* read pnp.

Page 146, last line, for *examined* read taken.